WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-DR-1 **Control No.:** 2012-094

Waste Site Code(s)/Subsite Code(s). 100-D-50:9

Reclassification Category: Interim ☒ Final ☐

Reclassification Status: Closed Out ☒ No Action ☐ Rejected ☐

RCRA Postclosure ☐ Consolidated ☐ None ☐

Approvals Needed: DOE ☒ Ecology ☒ EPA ☐

Description of current waste site condition:

The 100-D-50:9, 1607-DR3 Sanitary Sewer Pipelines were part of the 100-D-50 waste site, which has been divided into 10 separate subsites for purposes of environmental evaluation and response. The 100-D-50:9 subsite, located within the 100-DR-1 Operable Unit, consists of the residual sanitary sewer lines for the temporary construction camp located southeast of the 105-DR Reactor. The 100-D-50:9 subsite encompasses two functional pipeline groups: (1) the overflow drain line and (2) the residual sanitary sewer lines. The 100-D-50 100-DR Water Treatment Facilities Underground Pipelines waste site is identified as an additional candidate pipeline site in the *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision,* U.S. Environmental Protection Agency, Region 10, Seattle, Washington (EPA 2004). Confirmatory sampling determined that a portion of the 100-D-50:9 subsite failed to meet the direct exposure remedial action goals (RAGs) for benzo(a)pyrene. Therefore, this portion of the 100-D-50:9 subsite was recommended for remedial action. Remediation, verification sampling, and comparison of residual contaminant concentrations against cleanup levels have been performed in accordance with remedial action objectives and RAGs established by the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington,* U.S. Environmental Protection Agency, Region 10, Seattle, Washington, (Remaining Sites ROD) (EPA 1999).

Basis for reclassification:

The 100-D-50:9 subsite sampling results were evaluated in comparison to the RAGs. In accordance with this evaluation, the confirmatory and verification sampling results for the 100-D-50:9 subsite support a reclassification of the site to Interim Closed Out. The current waste site conditions achieve the RAGs established by the Remaining Sites ROD. The results of confirmatory and verification sampling show that residual contaminant concentrations do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow zone soils (i.e., surface to 4.6 m [15 ft] deep). The results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. Contamination above direct exposure levels was not observed in shallow zone soils and is concluded to not exist in deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone soil are not required. The basis for reclassification is described in detail in the *Remaining Sites Verification Package for the 100-D-50:9, 1607-DR3 Sanitary Sewer Pipelines* (attached).

WASTE SITE RECLASSIFICATION FORM

Operable Unit: 100-DR-1 **Control No.:** 2012-094

Waste Site Code(s)/Subsite Code(s). 100-D-50:9

Regulator comments:

Approval of this WSRF documents regulator agreement that the 100-D-50:9 subsite qualifies for "Interim Closed Out" under this Interim Action ROD. In addition, Ecology has evaluated the data for this site against WAC 173-340 (2007) clean-up levels for direct contact, groundwater protection, and river protection. This evaluation is documented in the letter transmitting Ecology's approval of the site's interim reclassification to "Interim Closed Out."

Waste Site Controls:

Engineered Controls: ☐ Yes ☒ No Institutional Controls: ☐ Yes ☒ No O&M Requirements: ☐ Yes ☒ No

If any of the Waste Site Controls are checked Yes, specify control requirements including reference to the Record of Decision, TSD Closure Letter, or other relevant documents:

J. P. Neath	JP Neath	1/11/13
DOE Federal Project Director (printed)	Signature	Date
N. Menard	Nina M. Menard	1/17/13
Ecology Project Manager (printed)	Signature	Date
N/A		
EPA Project Manager (printed)	Signature	Date

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-D-50:9, 1607-DR3 SANITARY SEWER PIPELINES

Attachment to Waste Site Reclassification Form 2012-094

February 2013

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-D-50:9, 1607-DR3 SANITARY SEWER PIPELINES

EXECUTIVE SUMMARY

The 100-D-50:9 1607-DR3 Sanitary Sewer Pipelines were part of the 100-D-50 waste site, which has been divided into 10 separate subsites for purposes of environmental evaluation and response. The 100-D-50:9 subsite, part of the 100-DR-1 Operable Unit, consists of the residual sanitary sewer lines for the temporary construction camp located southeast of the 105-DR Reactor. An overflow drain from the elevated reactor cooling water storage tank, previously located north of the 105-DR Reactor, also discharges to this sewer system and is considered within this subsite. This sewer system discharges to the 100-D-13 septic tank.

Confirmatory sampling of the 100-D-50:9 subsite was conducted on November 7, 2005. A stratified sampling strategy was employed to address the 100-D-50:9 pipelines subsite as two service areas based on the principles of hydraulics and the potential impact of different waste loading across the system. A total of eight samples were collected between the two service areas and consisted of soil samples from underneath the pipelines, sediment samples from within the pipelines, one field duplicate, and one equipment blank. An additional test pit was excavated and samples were collected on April 11, 2012, to support the closure of service area 1. One main sample and one duplicate were collected from the soil below the pipe. No sediment or scale was present within the pipe. Results of the confirmatory sampling event are used to make decisions for reclassification of the site in accordance with the reclassification guideline TPA-MP-14 procedure in the *Tri-Party Agreement Handbook Management Procedures* (DOE-RL 2011).

The confirmatory sample results for service area 1 met all applicable remedial action goals (RAGs) for direct exposure and protection of groundwater and the Columbia River, with the exception of lead, zinc, and aroclor-1260. Residual concentrations of these contaminants were detected in the pipeline sediments and failed the applicable soil RAGs for the protection of groundwater and/or the Columbia River; however, subsequent RESidual RADioactivity (RESRAD) modeling discussed in Appendix C of the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2009b) indicates that these contaminants will not reach groundwater (and thus the Columbia River) within a 1,000-year time frame. As such, service area 1 achieves the remedial action objectives established in the RDR/RAWP (DOE-RL 2009b) and the *Interim Action record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD) (EPA 1999).

The confirmatory sample results for pipe sediment in service area 2 failed to meet the direct exposure RAG for benzo(a)pyrene. Therefore, this service area was recommended for remedial action with benzo(a)pyrene carried forward as a contaminant of concern. Several analytes were detected at concentrations exceeding the Washington State background levels or Hanford Site-specific background levels. These analytes consisted of multiple metals (including mercury and hexavalent chromium), pesticides, semivolatile organic compounds, aroclor-1260, and cesium-137. These constituents are identified as contaminants of concern/contaminants of potential concern for verification sampling following remedial action.

The 100-D-50:9 subsite, service area 2 was remediated between January 25 and March 30, 2011. Approximately 1,800 bank cubic meters (BCM) (2,354 bank cubic yards [BCY]) of overburden material was stockpiled and sampled for use as clean backfill material. Approximately 287 linear meters (942 linear feet) of pipeline was removed from the 100-D-50:9 subsite, service area 2, resulting in approximately 565 BCM (739 BCY) of soil and piping removed and staged in a staging pile area for subsequent disposal at the Environmental Restoration Disposal Facility. Final loadout of material was completed in June 2011. The deepest part of the excavation extended to approximately 4 m (13 ft) below ground surface. No anomalous materials were encountered during the remedial action activities of service area 2.

Verification sampling for the 100-D-50:9 subsite, service area 2 was performed on August 22 and 23, 2012. A summary of the cleanup evaluation for the confirmatory and verification sampling results against the applicable RAGs is presented in Table ES-1.

Table ES-1. Summary of Remedial Action Goals for the 100-D-50:9 Subsite. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Direct Exposure – Radionuclides	Attain dose rate of <15 mrem/yr above background over 1,000 years.	The maximum dose rates from sum-of-fractions evaluations for the shallow zone decision units (i.e., excavation, overburden soil stockpile, and waste staging pile area footprint) using dose-equivalent lookup values are all <15 mrem/yr. The maximum cumulative dose rate for the waste site is 0.0915 mrem/yr.	Yes
Direct Exposure – Nonradionuclides	Attain individual COPC RAGs.	All individual COPC concentrations are below the direct exposure criteria.	Yes
Risk Requirements – Nonradionuclides	Attain a hazard quotient of <1 for all individual noncarcinogens.	The hazard quotients for individual nonradionuclide COPCs are <1.	Yes
	Attain a cumulative hazard quotient of <1 for noncarcinogens.	The cumulative hazard quotient for the excavation, overburden soil stockpile, and the waste staging pile area (service area 2) and test pits 1 and 4 (service area 1) are 2.6×10^{-2} and 2.5×10^{-3}, respectively, which are <1.	
	Attain an excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	The excess cancer risk for individual constituents subject to the cancer risk calculation for service area 1 and service area 2 are $<1 \times 10^{-6}$.	
	Attain a cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	The excess cancer risk for the excavation, overburden soil stockpile, and the waste staging pile area (service area 2) is 7.3×10^{-7} and test pits 1 and 4 (service area 1) is 1.4×10^{-7}, which are $<1 \times 10^{-5}$.	

Table ES-1. Summary of Remedial Action Goals for the 100-D-50:9 Subsite. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Groundwater/River Protection – Radionuclides	Attain single COPC groundwater and river RAGs.	Radionuclide COPCs were not quantified at activities above groundwater/river protection look up values	Yes
	Attain National Primary Drinking Water Regulations: 4 mrem/yr (beta/gamma) dose standard to target receptor/organ [a].	Radionuclide COPCs were not quantified at activities above groundwater/river protection look up values	
	Meet drinking water standards for alpha emitters: the more stringent of 15 pCi/L MCL or 1/25th of the derived concentration guide for DOE Order 5400.5 [b].	No alpha-emitting radionuclide COPCs were quantified above groundwater/river protection lookup values.	
	Meet total uranium standard of 21.2 pCi/L [c].	Uranium was not quantified above background levels for this site.	
Groundwater/River Protection – Nonradionuclides	Attain individual nonradionuclide groundwater and Columbia River cleanup requirements.	Benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, aroclor-1254, aroclor-1260, total PCBs, lead, and zinc are present at concentrations above soil RAGs for groundwater and/or Columbia River protection. However, based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), it is predicted that these constituents will not reach groundwater (and thus the Columbia River) within 1,000 years [d].	Yes

[a] "National Primary Drinking Water Regulations" (40 *Code of Federal Regulations* 141).
[b] *Radiation Protection of the Public and Environment* (DOE Order 5400.5).
[c] Based on the isotopic distribution of uranium in the 100 Area, the 30 µg/L MCL corresponds to 21.2 pCi/L. Concentration-to-activity calculations are documented in *Calculation of Total Uranium Activity Corresponding to a Maximum Contaminant Level for Total Uranium of 30 Micrograms per Liter in Groundwater* (BHI 2001).
[d] Based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), residual concentrations of benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, aroclor-1254, aroclor-1260, total PCBs, lead, and zinc are not predicted to migrate more than 1.8 m (5.90 ft) vertically in 1,000 years (based on the lowest distribution coefficient of the contaminants [lead and zinc] of 30 mL/g). The vadose zone underlying the soil beneath the excavation is approximately 20 m (65.6 ft) thick. Therefore, residual concentrations of these contaminants are predicted to be protective of groundwater and consequently are protective of the Columbia River.

COPC = contaminant of potential concern
MCL = maximum contaminant level
PCB = polychlorinated biphenyl
RAG = remedial action goal
RDR/RAWP = *Remedial Design Report/Remedial Action Work Plan for the 100 Area*
RESRAD = RESidual RADioactivity (dose model)

The results of the confirmatory and verification sampling are used to make reclassification decisions for the 100-D-50:9 subsite in accordance with the TPA-MP-14 procedure in the *Tri-Party Agreement Handbook Management Procedures* (DOE-RL 2011).

In accordance with this evaluation, the confirmatory and verification sampling results support a reclassification of this site to Interim Closed Out. The current site conditions achieve the RAOs and the corresponding RAGs established in the RDR/RAWP (DOE-RL 2009b) and the Remaining Sites ROD (EPA 1999). These results show that residual soil concentrations support future land uses that can be represented (or bounded) by a rural-residential scenario. The results also demonstrate that residual contaminant concentrations support unrestricted future use of shallow zone soil (i.e., surface to 4.6 m [15 ft]), and contaminant levels remaining in the soil are protective of groundwater and the Columbia River. Contamination above direct exposure levels was not observed in shallow zone soils and is concluded to not exist in deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required.

Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based in part on a limited ecological risk assessment. Although not required by the Remaining Sites ROD, a comparison against ecological risk screening levels has been made for the 100-D-50:9 subsite contaminants of potential concern and other constituents (Appendix A). The highest maximum or statistical value from the confirmatory soil sampling from service area 1 or the verification soil sampling from the service area 2 excavation, overburden soil pile, or staging pile area were considered for comparison. Ecological screening levels from *Washington Administrative Code* 173-340 were exceeded for boron and vanadium. The U.S. Environmental Protection Agency's ecological soil screening levels were exceeded for antimony, lead, manganese, vanadium, and zinc. Exceedance of screening values is intended to trigger additional evaluation and does not necessarily indicate the existence of risk to ecological receptors. Because concentrations of antimony, manganese, and vanadium are below Hanford Site or Washington State background values (note that state background values are only used when Hanford Site background values are not available), it is believed that the presence of these constituents does not pose a risk to ecological receptors. All exceedances will be evaluated in the context of additional lines of evidence for risk to ecological receptors as part of the final closeout decision for this site.

REMAINING SITES VERIFICATION PACKAGE FOR THE 100-D-50:9, 1607-DR3 SANITARY SEWER PIPELINES

STATEMENT OF PROTECTIVENESS

The 100-D-50:9, 1607-DR3 Sanitary Sewer Pipeline subsite confirmatory and verification sampling data demonstrate that this subsite meets the objectives established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2009b) and the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD) (EPA 1999). These results show that residual soil concentrations support future land uses that can be represented (or bounded) by a rural-residential scenario. The results also demonstrate that residual contaminant concentrations support unrestricted future use of shallow zone soil (i.e., surface to 4.6 m [15 ft]) and that contaminant levels remaining in the soil are protective of groundwater and the Columbia River. Contamination above direct exposure levels was not observed in shallow zone soils and is concluded to not exist in deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required.

Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based in part on a limited ecological risk assessment. Although not required by the Remaining Sites ROD, a comparison against ecological risk screening levels has been made for the 100-D-50:9 subsite contaminants of potential concern (COPCs) and other constituents (Appendix A). The highest maximum or statistical value from the confirmatory soil sampling from service area 1 or the verification soil sampling from the service area 2 excavation, overburden soil pile, or staging pile area were considered for comparison. Ecological screening levels from *Washington Administrative Code* (WAC) 173-340 were exceeded for boron and vanadium. The U.S. Environmental Protection Agency's (EPA's) ecological soil screening levels were exceeded for antimony, lead, manganese, vanadium, and zinc. Exceedance of screening values is intended to trigger additional evaluation and does not necessarily indicate the existence of risk to ecological receptors. Because concentrations of antimony, manganese, and vanadium are below Hanford Site or Washington State background values (note that state background values are only used when Hanford Site background values are not available), it is believed that the presence of these constituents does not pose a risk to ecological receptors. All exceedances will be evaluated in the context of additional lines of evidence for risk to ecological receptors as part of the final closeout decision for this site.

GENERAL SITE INFORMATION

The 100-D-50 100-DR Water Treatment Facilities Underground Pipelines waste site is identified as an additional candidate pipeline site in the *Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision* (EPA 2004). The 100-D-50 site encompasses the underground pipelines associated with pre-reactor process cooling water, process wastewater, and sanitary wastewater. This site has been administratively divided into 10 subsites based on process knowledge, COPCs, and possible remedial actions. The 100-D-50:9 subsite is located in the 100-DR-1 Operable Unit and consists of the residual sanitary sewer lines for the temporary construction camp southeast of the 105-DR Reactor. An overflow drain from the elevated reactor cooling water storage tank associated with the 105-DR Reactor also discharges to this sewer system and is considered within this subsite.

The 100-D-50:9 subsite encompasses two functional pipeline groups: (1) the overflow drain line and (2) the residual sanitary sewer lines. The overflow drain line begins north of the 105-DR Reactor Building, travels south along the western side of the building, and then turns east to join the sanitary sewage system (Figure 1). The sanitary sewer cuts across the southeast corner of the 116-D-8 cask storage pad and was accessible through a manhole set in the concrete pad. The *Hanford Site Waste Management Units Report* (DOE-RL 1989) stated the pad was designed with a drain to facilitate pad decontamination and rain runoff, and the drain discharged into the 105-DR sewer (100-D-50:9). The residual sanitary sewer lines are located south and southeast of the 105-DR Reactor Building (Figure 1). A pipeline entered the east side of a small structure located west of the 118-D-3:1 Burial Ground. The pipe is a water line that tied into a 6" cast iron water main pipeline. The 100-D-50:9 exited the west side of the small structure and turned to the south. Both pipeline functional groups discharged to the 100-D-13 septic tank.

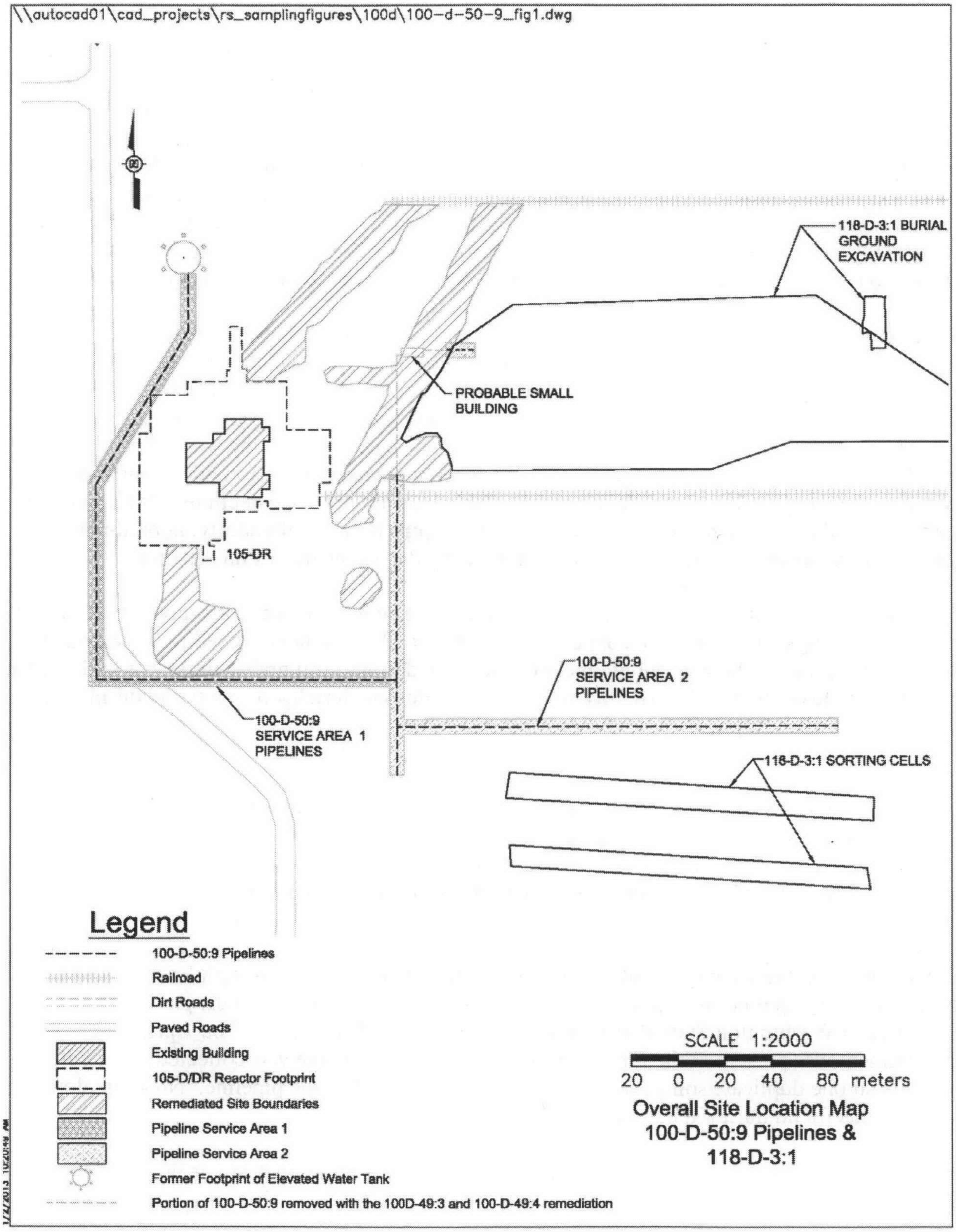
CONFIRMATORY SAMPLING SUMMARY

Contaminants of Potential Concern

The COPCs for the 100-D-50:9 subsite were identified based on existing historical information and possible use of the site. The COPC list identified in the *100 Area Remedial Action Sampling and Analysis Plan* (SAP) (DOE-RL 2009a) includes cobalt-60, cesium-137, europium-152, europium-154, strontium-90, lead, hexavalent chromium, arsenic, barium, cadmium, chromium (total), mercury, selenium, and silver. Previous investigations of sanitary waste systems have shown the presence of constituents unrelated to sanitary sewage. To accommodate the potential for nonsanitary waste loading to the 100-D-50:9 sanitary sewer lines, polychlorinated biphenyls (PCBs), pesticides, and semivolatile organic compounds (SVOCs) were added as COPCs for this site. Although the septic system was designed to receive nonradiological waste, the following radionuclide COPCs were included to address the possibility of nondesign waste loading: americium-241, europium-155, and plutonium-239/240. All confirmatory samples were analyzed for total uranium by kinetic phosphorescence analysis. Total petroleum hydrocarbon (TPH) and herbicide analysis were also inadvertently requested for the pipeline sediment sample collected in service area 1, in addition to the aforementioned COPCs.

Field screening for volatile organic compounds was performed during sampling to assess the need for volatile organic analysis. As no volatile organic compounds were detected in the field, volatile organic analysis was not included in the requested analyses for any of the samples. Similarly, if suspect asbestos-containing material was identified during confirmatory sampling activities, representative samples would have been collected and submitted for asbestos analysis; however, no such materials were observed.

Figure 1. 100-D-50:9 Sanitary Sewer Pipelines Site Location Map.



Confirmatory Sample Design

A stratified sampling strategy was employed to address the 100-D-50:9 subsite as two service areas. These service areas, shown in Figure 2, were determined based on the principles of hydraulics and the potential impact of different waste loading across the system. Representative samples were collected from the pipe system and underlying soil in each of the two service areas identified for the 100-D-50:9 subsite (WCH 2005a, 2005b, 2005c). The confirmatory sample design (WCH 2005d) included the excavation of three test pits along the 100-D-50:9 pipelines in order to access the pipe sediment and underlying soil (Figure 2). Two of the test pits were located within service area 2. Each test pit was excavated at an unlabeled manhole associated with the pipelines. Excavations within the two service areas confirmed that portions of the former construction camp sewer lines and elevated water tank drain line still remain.

A sediment sample was collected from within the concrete junction box associated with the pipeline in service area 1 (Figures 2 and 3). The sediment sample, which consisted of moist, sandy-silt mixed with pebbles, was retrieved from an approximate depth of 1.5 m (5 ft) below ground surface (bgs). Confirmatory sampling of the junction box revealed two inlet pipes: one entering from the north (as depicted in Figure 2) and one entering from the west. The sediment sample was collected at a location representative of both intake pipes. An underlying soil grab sample was taken from beneath the west intake pipe at an approximate depth of 6 ft (1.7 m) bgs. Sampling could not take place below the north intake pipe because of underlying hard-packed cobble. No anomalous material/soil was found during the excavation of this test pit.

Excavations at test pit 2, service area 2, exposed the east outlet pipeline at an approximate depth of 1.2 m (4 ft) bgs. This pipeline connects to the 100-D-13 septic tank. A sediment sample was collected from inside the east outlet pipeline, and an underlying soil grab sample was collected at an approximate depth of 1.4 m (4.5 ft) bgs. No anomalous material/soil was found during the excavation of this test pit.

No sediment was present within the junction box at test pit 3, service area 2. Excavations near the manhole exposed the concrete pipeline on the north side of the junction box. Sediment was collected from inside the north inlet pipeline at an approximate depth of 1.5 m (5 ft) bgs. A representative soil grab sample was collected from underneath the pipeline at an approximate depth of 1.7 m (5.5 ft) bgs. No anomalous material/soil was found during the excavation of this test pit.

The Washington State Department of Ecology requested an additional test pit be excavated along the 100-D-50:9 pipelines to support closure of service area 1 (Figure 3). Test pit 4 was excavated at Washington State Plane coordinates N 151191.1, E 573821.7 on April 11, 2012. No sediment was present in the pipe; therefore, no sediment sample was collected. One soil sample and one duplicate soil sample were collected from below the pipeline. No anomalous material was found during the excavation of this test pit.

A summary of the confirmatory samples collected at the 100-D-50:9 subsite is provided in Table 1.

Figure 2. Service Areas and Sampling Locations for the 100-D-50:9 Pipelines.

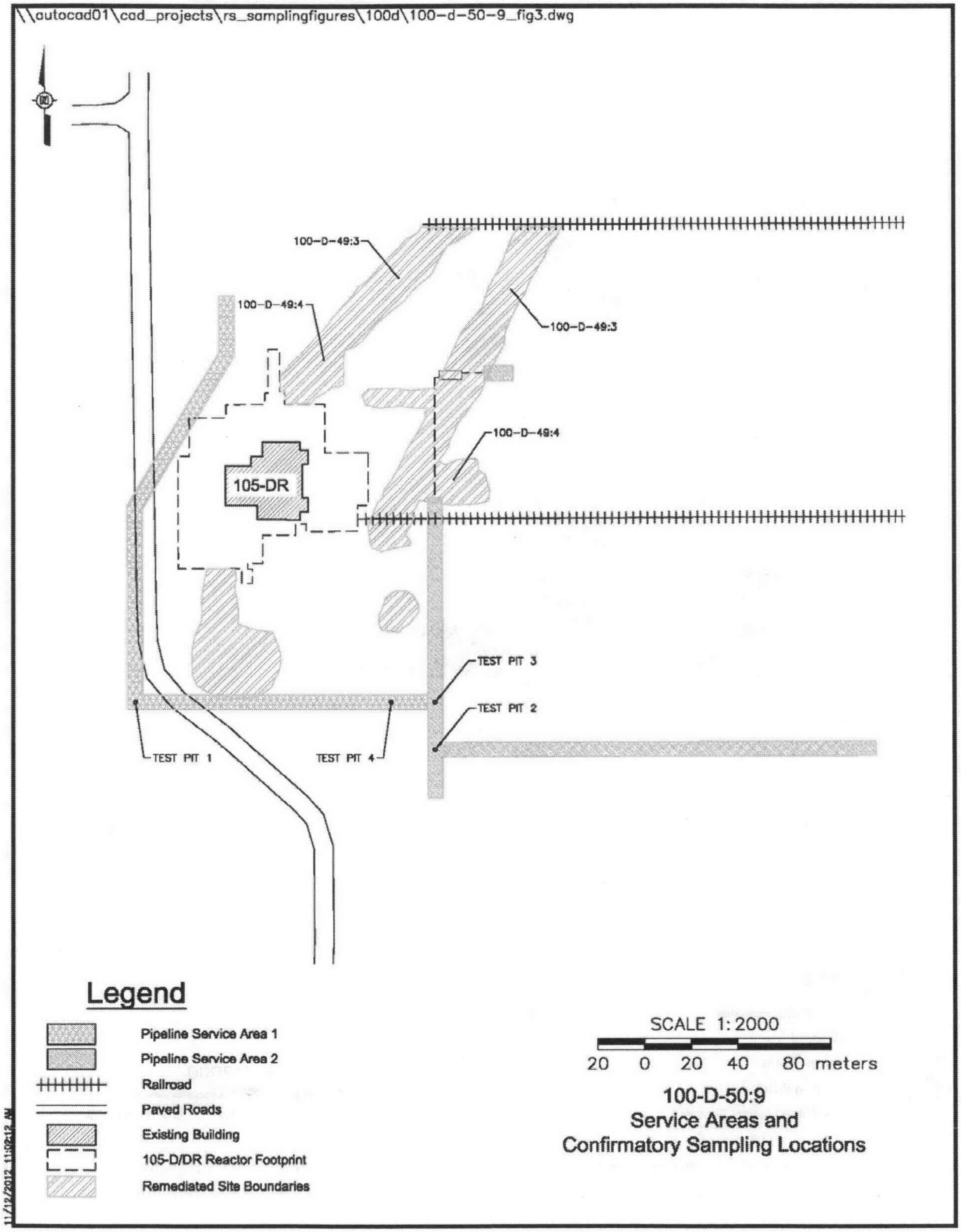


Figure 3. Test Pit Locations for the 100-D-50:9 Pipelines, Service Areas 1 and 2.

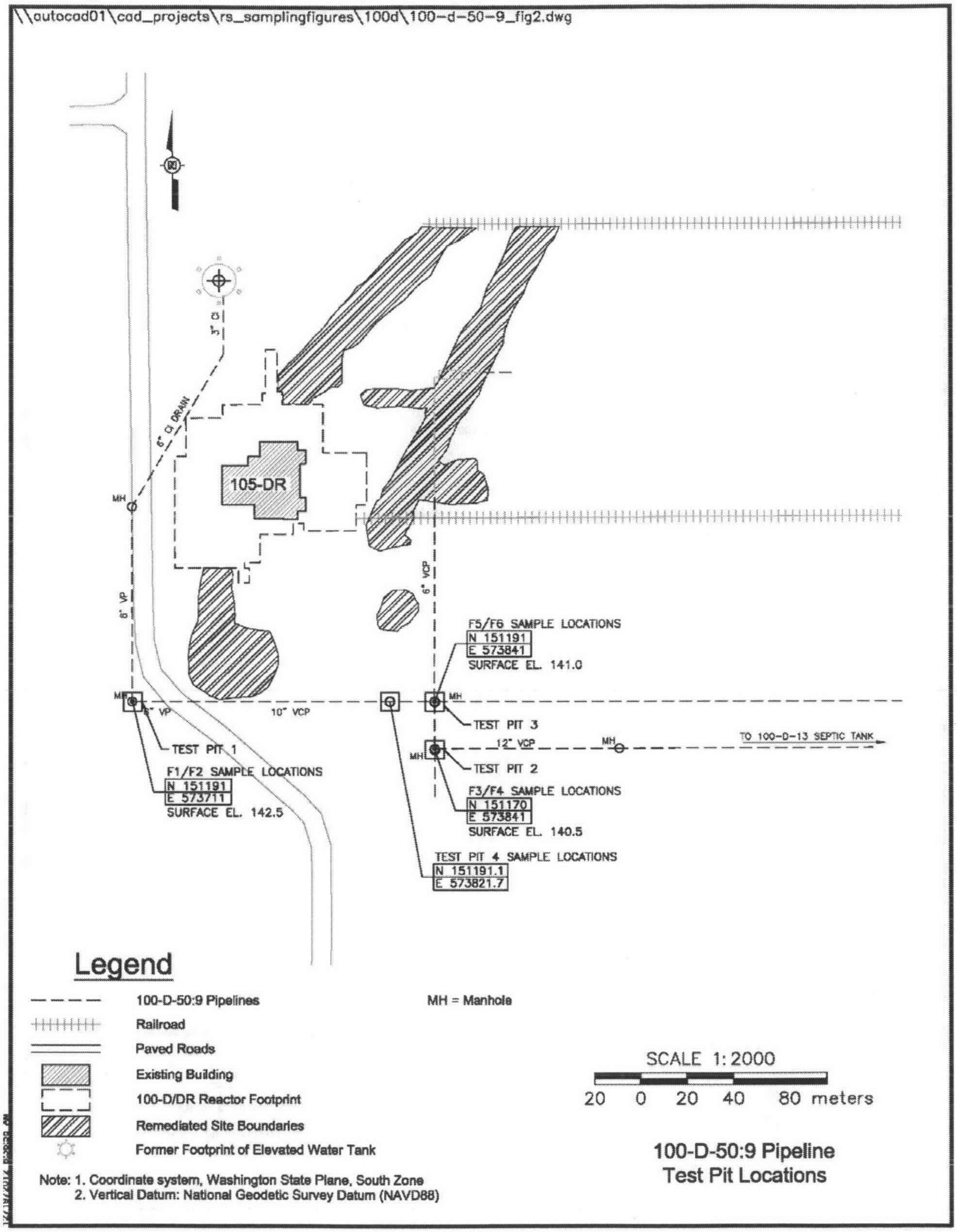


Table 1. Confirmatory Sample Summary for the 100-D-50:9 Sanitary Sewer Pipelines Subsite, Service Area 1 and 2.

Sample Location and Type	Sample Number	Washington State Plane Coordinates		Depth (Field Est.)	Analysis
		Northing (m)	Easting (m)		
Service Area 1 Test Pit 1, Junction box sediment	J10FJ2	151191	573711	1.5 m bgs	ICP metals [a], mercury, KPA, SVOA, PCB, pesticides, TPH, herbicides, GEA, gross beta, gross alpha
	J10FJ9				Hexavalent chromium
Service Area 1 Test Pit 1, Soils underlying west pipe	J10FH6	151191	573711	1.7 m bgs	ICP metals [a], mercury, hexavalent chromium, KPA, SVOA, PCB, pesticides, GEA, gross beta, gross alpha
Service Area 1 Test Pit 4, Soils underlying pipe	J1NPD9	151191.1	573821.7	Not indicated	ICP metals [a], mercury, hexavalent chromium, KPA, SVOA, PCB, pesticides, GEA, gross beta, gross alpha
Duplicate of Service Area 1 Test Pit 4, Soils underlying pipe	J1NPF0	151191.1	573821.7	Not indicated	ICP metals [a], mercury, hexavalent chromium, KPA, SVOA, PCB, pesticides, GEA, gross beta, gross alpha
Service Area 2 Test Pit 2, Pipe sediment	J10FH9	151170	573841	1.2 m bgs	ICP metals [a], mercury, KPA, SVOA, PCB, pesticides, GEA, gross beta, gross alpha
	J10FJ6				Hexavalent chromium
Service Area 2 Test Pit 2, Soils underlying pipe	J10FH5	151170	573841	1.4 m bgs	ICP metals [a], mercury, hexavalent chromium, KPA, SVOA, PCB, pesticides, GEA, gross beta, gross alpha
Service Area 2 Test Pit 3, Pipe sediment	J10FH7	151191	573841	1.5 m bgs	ICP metals [a], mercury, KPA, SVOA, PCB, pesticides, GEA, gross beta, gross alpha
	J10FJ4				Hexavalent chromium
Service Area 2 Test Pit 3, Soils underlying pipe	J10FH3	151191	573841	1.7 m bgs	ICP metals [a], mercury, hexavalent chromium, KPA, SVOA, PCB, pesticides, GEA, gross beta, gross alpha
Service Area 2 Duplicate of Test Pit 3, Pipe sediment	J10FH8	151191	573841	1.5 m bgs	ICP metals [a], mercury, KPA, SVOA, PCB, pesticides, GEA, gross beta, gross alpha
	J10FJ5				Hexavalent chromium
Equipment blank	J10FH4	NA	NA	NA	ICP metals [a], mercury, SVOA

Source: Remaining Sites Field Sampling Logbooks (WCH 2005a, 2005b, 2005c).

[a] The expanded list of ICP metals were performed to include antimony, arsenic, barium, beryllium, boron, cadmium, chromium (total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc in the analytical results package.

bgs = below ground surface
GEA = gamma energy analysis
ICP = inductively coupled plasma
KPA = kinetic phosphorescence analysis
NA = not applicable
PCB = polychlorinated biphenyl
SVOA = semivolatile organic analysis
TPH = total petroleum hydrocarbons

Confirmatory Sample Results

Confirmatory sampling of the 100-D-50:9 subsite was performed on November 7, 2005. A supplementary test pit was excavated and additional confirmatory samples were collected on April 11, 2012. The samples were analyzed using analytical methods approved by the EPA. The results are stored in the Environmental Restoration (ENRE) project-specific database prior to archiving in the Hanford Environmental Information System (HEIS) and are included in Appendix B.

A comparison of the maximum concentrations of detected analytes in the pipeline sediment and underlying soils are summarized along with the site remedial action goals (RAGs) for service area 1 (test pits 1 and 4) in Tables 2 and 3, respectively. Contaminants that were not detected by laboratory analysis are excluded from these tables. Calculated cleanup levels are not presented in the Model Toxics Control Act Cleanup Levels and Risk Calculations database under WAC 173-340-740(3) for calcium, magnesium, potassium, silicon, and sodium. The EPA's *Risk Assessment Guidance for Superfund* (EPA 1989) recommends that aluminum and iron not be considered in site risk evaluations. Therefore, aluminum, calcium, iron, magnesium, potassium, silicon, and sodium are not considered site COPCs and are also not included in these tables. Potassium-40, radium-226, radium-228, thorium-228, and thorium-232 were detected in samples collected at the 100-D-50:9 subsite, but are not considered within Tables 2 and 3 because these isotopes are not related to the operational history of the site. The laboratory-reported data results for all constituents are provided in Appendix B.

Table 2. Comparison of Maximum Detected Contaminant Concentrations to Action Levels for the 100-D-50:9 Confirmatory Sampling Event (Service Area 1 – Pipe Sediment). (2 Pages)

COPC	Maximum Result[b] (pCi/g)	Generic Site Lookup Values[a] (pCi/g)			Does the Result Exceed Lookup Values?	Does the Result Pass RESRAD Modeling?
		Shallow Zone Lookup Value	Groundwater Protection Lookup Value	River Protection Lookup Value		
Cesium-137	0.638 (<BG)	6.2	1,465	2,930	No	--
COPC	**Maximum Result[b] (mg/kg)**	**Remedial Action Goals[a] (mg/kg)**			**Does the Result Exceed RAGs?**	**Does the Result Pass RESRAD Modeling?**
		Direct Exposure	**Soil Cleanup Level for Groundwater Protection**	**Soil Cleanup Level for River Protection**		
Barium	71.4 (<BG)	5,600	200	400	No	--
Boron[c]	12.1	7,200	320	--[d]	No	--
Chromium (total)	13.4 (<BG)	80,000	18.5[e]	18.5[e]	No	--
Cobalt	7.1 (<BG)	24	15.7[e]	--[d]	No	--
Copper	17.6 (<BG)	2,960	59.2	22.0[e]	No	--
Lead	16.3	353	10.2[e]	10.2[e]	Yes	Yes[f]
Manganese	298 (<BG)	3,760	512[e]	512[e]	No	--
Mercury	0.22 (<BG)	24	0.33[e]	0.33[e]	No	--
Molybdenum[c]	1.0	400	8	--[d]	No	--

Table 2. Comparison of Maximum Detected Contaminant Concentrations to Action Levels for the 100-D-50:9 Confirmatory Sampling Event (Service Area 1 – Pipe Sediment). (2 Pages)

COPC	Maximum Result [b] (mg/kg)	Remedial Action Goals [a] (mg/kg)			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Nickel	9.7 (<BG)	1,600	19.1 [e]	27.4	No	--
Uranium	1.06 (<BG)	240	3.21 [e]	3.21 [e]	No	--
Vanadium	45.9 (<BG)	560	85.1 [e]	-- [d]	No	--
Zinc	71.1	24,000	480	67.8 [e]	Yes	Yes [f]
Aroclor-1260	0.025	0.5	0.017 [g]	0.017 [g]	Yes	Yes [f]
4,4'-DDE	0.0012	2.94	0.0257	0.0033 [g]	No	--
2,4-D	0.047	640	12.8	-- [d]	No	--
Acenaphthene	0.022	4,800	96	129	No	--
Anthracene	0.035	24,000	240	1,920	No	--
Benzo(a)anthracene	0.160	1.37	0.33 [g]	0.33 [g]	No	--
Benzo(a)pyrene	0.160	0.33 [g]	0.33 [g]	0.33 [g]	No	--
Benzo(b)fluoranthene	0.150	1.37	0.33 [g]	0.33 [g]	No	--
Benzo(ghi)perylene [h]	0.092	2,400	48	192	No	--
Benzo(k)fluoranthene	0.150	1.37	0.33 [g]	0.33 [g]	No	--
Carbazole	0.020	50	0.438	-- [d]	No	--
Chrysene	0.210	13.7	0.12	0.33 [g]	No	--
Dibenz(a,h) anthracene	0.026	1.37	0.03 [g]	0.03 [g]	No	--
Fluoranthene	0.260	3,200	64	18.0	No	--
Indeno(1,2,3-cd)pyrene	0.078	1.37	0.33 [g]	0.33 [g]	No	--
Phenanthrene [h]	0.170	24,000	240	1,920	No	--
Pyrene	0.320	2,400	48	192	No	--

[a] Lookup values and RAGs obtained from the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (100 Area RDR/RAWP) (DOE-RL 2009b), unless otherwise noted.
[b] Maximum sediment result, as described in the *100-D-50:9 Subsite Service Area 1 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations* (Appendix B).
[c] No Hanford Site-specific or Washington State BG value is available.
[d] No parameters (bioconcentration factors or ambient water quality criteria values) are available from the Ecology Cleanup Levels and Risk Calculations database (Ecology 2012) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [Ecology 1996] [Method B for surface waters]).
[e] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (Ecology 1996).
[f] Based on the RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), residual concentrations of lead, zinc, and aroclor-1260 are not expected to migrate more than 1.8 m (5.9 ft) vertically in 1,000 years (based on the lowest distribution coefficient of the constituents [lead and zinc] of 30 mL/g). The vadose zone underlying the excavation is approximately 20 m (65.6 ft) thick. Therefore, residual concentrations of lead, zinc, and aroclor-1260 are predicted to be protective of groundwater and the Columbia River.
[g] Where cleanup levels are less than RDLs, cleanup levels default to RDLs per WAC 173-340-707(2) (Ecology 1996). The cited RDLs are based on EPA-approved analytical methods that may not be available for rapid-turnaround analyses.
[h] Toxicity data for this chemical are not available. Cleanup levels are based on surrogate chemicals: contaminant: benzo(ghi)perylene; surrogate: pyrene, phenanthrene; surrogate: anthracene.

-- = not applicable
BG = background
COPC = contaminant of potential concern
EPA = U.S. Environmental Protection Agency
RAG = remedial action goal
RDL = required detection limit
RDR/RAWP = *Remedial Design Report/Remedial Action Work Plan*
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

Table 3. Comparison of Maximum Detected Contaminant Concentrations to Action Levels for the 100-D-50:9 Confirmatory Sampling Event (Service Area 1 – Soil).

COPC	Maximum Result [b] (mg/kg)	Remedial Action Goals [a] (mg/kg)			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Arsenic	3.4 (<BG)	20 [c]	20 [c]	20 [c]	No	--
Barium	66.6 (<BG)	5,600	200	400	No	--
Beryllium	0.60 (<BG)	10.4 [d]	1.51 [c]	1.51 [c]	No	--
Boron [e]	1.5	7,200	320	-- [f]	No	--
Cadmium [g]	0.12 (<BG)	13.9 [d]	0.81 [c]	0.81 [c]	No	--
Chromium (total)	8.7 (<BG)	80,000	18.5 [c]	18.5 [c]	No	--
Cobalt	8.1 (<BG)	24	15.7 [c]	-- [e]	No	--
Copper	16.2 (<BG)	2,960	59.2	22.0 [c]	No	--
Hexavalent chromium [e]	0.28	2.1 [d]	4.8	2	No	--
Lead	4.0 (<BG)	353	10.2 [c]	10.2 [c]	No	--
Manganese	337 (<BG)	3,760	512 [c]	512 [c]	No	--
Mercury	0.0061 (<BG)	24	0.33 [c]	0.33 [c]	No	--
Molybdenum [e]	0.42	400	8	-- [f]	No	--
Nickel	11.3 (<BG)	1,600	19.1 [c]	27.4	No	--
Uranium	1.37 (<BG)	240	3.21 [c]	3.21 [c]	No	--
Vanadium	54.3 (<BG)	560	85.1 [c]	-- [f]	No	--
Zinc	55.7 (<BG)	24,000	480	67.8 [c]	No	--
TPH – diesel	3.900	200	200	200	No	--
TPH – diesel extended	8.300	200	200	200	No	--
bis(2-Ethylhexyl) phthalate	0.19	71.4	0.6	0.36	No	--

[a] RAGs obtained from the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (100 Area RDR/RAWP) (DOE-RL 2009b), unless otherwise noted.
[b] Maximum soil result, as described in the *100-D-50:9 Subsite Service Area 1 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations* (Appendix B).
[c] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (Ecology 1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement Project Managers as discussed in Section 2.1.2.1 of the 100 Area RDR/RAWP (DOE-RL 2009b).
[d] Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340-750[3] (Ecology 1996) using an airborne particulate mass-loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997])
[e] No Hanford Site-specific or Washington State BG value is available.
[f] No parameters (bioconcentration factors or ambient water quality criteria values) are available from the Ecology Cleanup Levels and Risk Calculations database (Ecology 2012) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [Ecology 1996] [Method B for surface waters]).
[g] Hanford Site-specific background not available. Value is Washington State background from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

-- = not applicable
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDR/RAWP = *Remedial Design Report/Remedial Action Work Plan for the 100 Area*
RESRAD = RESidual RADioactivity (dose model)
TPH = total petroleum hydrocarbons
WAC = *Washington Administrative Code*

Service Area 1

Samples collected from the underlying soils in service area 1 meet all applicable RAGs for direct exposure and protection of groundwater and/or the Columbia River, as shown in Table 3. Sediment samples collected from the pipelines in service area 1 meet all applicable RAGs for direct exposure. Lead, zinc, and aroclor-1260 were detected in the pipe sediments at concentrations exceeding the applicable soil RAGs for the protection of groundwater and/or the Columbia River, as shown in Table 2. Based on the lowest soil-partitioning coefficient (K_d) values for these constituents (30 mL/g for lead and zinc), RESidual RADioactivity (RESRAD) modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b) predicts that lead, zinc, and aroclor-1260 will not reach groundwater, at an elevation of 118 m (387 ft), within a 1,000-year time frame; residual concentrations of these contaminants are therefore protective of groundwater and consequently the Columbia River.

Service area 1 did not require remedial action because it achieved the remedial action objectives established in the RDR/RAWP (DOE-RL 2009b) and the Remaining Sites ROD (EPA 1999).

Service Area 2

Benzo(a)pyrene was detected in the pipeline sediment of service area 2 at a concentration of 0.76 mg/kg, which is in exceedance of the direct exposure soil RAG. Therefore, all of service area 2 was recommended for remedial action with benzo(a)pyrene as a contaminant of concern. Several analytes were detected at concentrations exceeding the Washington State background levels or Hanford Site-specific background levels. These analytes consisted of multiple metals (including mercury and hexavalent chromium), pesticides, SVOCs, aroclor-1260, and cesium-137. Following remediation, residual concentrations of the contaminants quantified above background during confirmatory sampling were reevaluated for attainment of remedial action objectives and goals.

REMEDIAL ACTION SUMMARY

Remedial action at the 100-D-50:9 subsite, service area 2 began on January 25, 2011, with overburden removal. Remediation of service area 2 continued through March 30, 2011. Approximately 1,800 bank cubic meters (BCM) (2,354 bank cubic yards [BCY]) of overburden material was stockpiled for use as clean backfill material. Approximately 287 linear meters (942 linear feet) of pipeline was removed from the 100-D-50:9 subsite, service area 2 resulting in approximately 565 BCM (739 BCY) of soil and piping removed and staged in a staging pile area for subsequent disposal at the Environmental Restoration Disposal Facility (ERDF). Final loadout of material was completed in June 2011. The post excavation civil survey is presented in Figure 4. An aerial photograph showing the 100-D-50:9 post-excavation is presented in Figure 5.

Figure 4. 100-D-50:9 Subsite, Service Area 2 Post-Excavation Civil Survey.

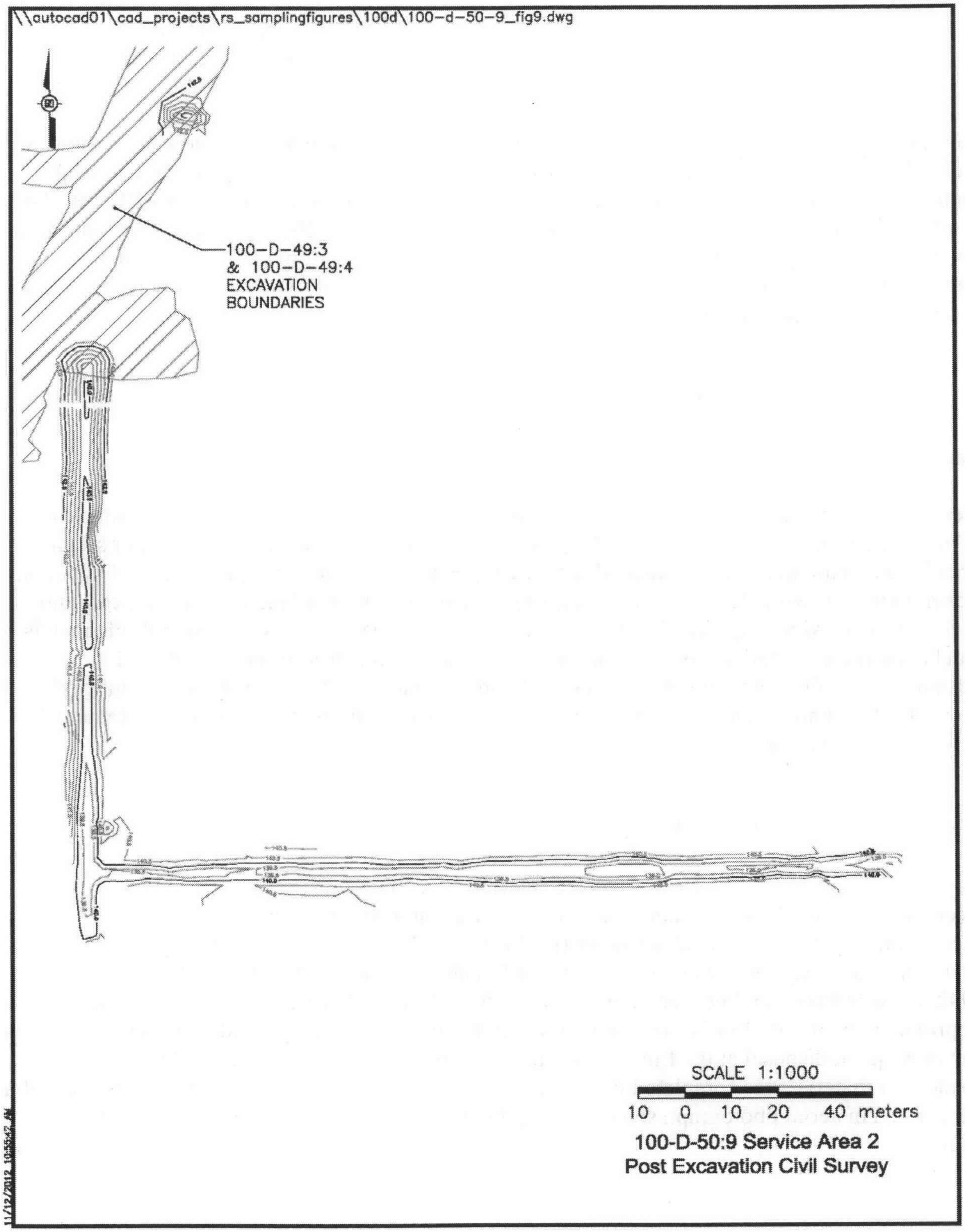


Figure 5. 100-D-50:9 Subsite, Service Area 2 Post-Excavation Aerial Photograph.

An approximate 45-m (148-ft) section of the 100-D-50:9 pipeline, part of service area 2, was removed and disposed at the ERDF as part of the 100-D-49:3 and 100-D-49:4 pipeline remediation completed in 2001. Figure 2 shows the 100-D-49:3 and 100-D-49:4 remediation boundaries. Additionally, a small section of the 100-D-50:9 pipeline, included as part of service area 2 and located approximately 50 m north of the portion of 100-D-50:9 service area 2 that was remediated in 2011, was shown on the waste site location map just west of the 118-D-3:1 Burial Ground (Figure 1). However, no pipe was found to be present during remediation. A pit measuring approximately 6 m (16.4 ft) long by 2.5 m (8.2 ft) wide (at the base) and 2 m (6.5 ft) deep was excavated to locate the pipe. A geophysical survey was conducted within the excavation to determine if the pipe was located deeper. No radar reflections characteristic of a pipe, an encasement, or other features often associated with a pipe were detected in the ground-penetrating radar data (WCH 2011). Additionally, no pipeline was found to be present in the west sidewall of the 118-D-3:1 Burial Ground remediation. The pipe is believed to have been removed during the 100-D-49:3 pipelines remediation. One focused sample was placed in the center of the pit below where the pipe was expected to be located and will be used to close out this section of pipeline (Table 4).

No anomalous materials were encountered during remedial action activities at the 100-D-50:9 subsite, service area 2.

Table 4. 100-D-50:9 Subsite, Service Area 2 Verification Sample Summary.

Sample Location	HEIS Sample Number	Washington State Plane Northing (m)	Washington State Plane Easting (m)	Sample Analysis
EXC-1	J1R058	151178.2	573840.2	GEA, ICP metals [a], mercury, hexavalent chromium, PAH, PCBs, pesticides
EXC-2	J1R059	151171.0	573842.2	
EXC-3	J1R060	151197.8	573841.5	
EXC-4	J1R061	151224.6	573840.9	
EXC-5	J1R062	151251.4	573840.3	
EXC-6	J1R063	151271.1	573841.6	
EXC-7	J1R064	151170.6	573869.0	
EXC-8	J1R065	151170.2	573895.8	
EXC-9	J1R066	151169.8	573922.6	
EXC-10	J1R067	151171.3	573942.3	
EXC-11	J1R068	151170.9	573969.1	
EXC-12	J1R069	151170.5	573995.9	
Duplicate of EXC-1	J1R070	151178.2	573840.2	
FS-1 [b]	J1R071	151335.4	573861.6	
OB-1	J1R072	151222.7	573735.1	GEA, ICP metals [a], mercury, hexavalent chromium, PAH, PCBs, pesticides
OB-2	J1R073	151222.7	573746.2	
OB-3	J1R074	151232.3	573729.5	
OB-4	J1R075	151232.3	573740.6	
OB-5	J1R076	151232.3	573751.8	
OB-6	J1R077	151242.0	573723.9	
OB-7	J1R078	151242.0	573735.1	
OB-8	J1R079	151242.0	573746.2	
OB-9	J1R080	151242.0	573757.4	
OB-10	J1R081	151251.6	573729.5	
OB-11	J1R082	151251.6	573740.6	
OB-12	J1R083	151251.6	573751.8	
Duplicate of OB-12	J1R084	151251.6	573751.8	
SPA-1	J1R086	151223.7	573809.7	GEA, ICP metals [a], mercury, hexavalent chromium, PAH, PCBs, pesticides
SPA -2	J1R087	151223.7	573817.8	
SPA -3	J1R088	151223.7	573826.0	
SPA -4	J1R089	151230.8	573813.8	
SPA -5	J1R090	151230.8	573821.9	
SPA -6	J1R091	151237.8	573817.8	
SPA -7	J1R092	151237.8	573826.0	
SPA -8	J1R093	151244.9	573813.8	
SPA -9	J1R094	151244.9	573821.9	
SPA -10	J1R095	151251.9	573817.8	
SPA -11	J1R096	151251.9	573826.0	
SPA -12	J1R097	151259.0	573821.9	
Duplicate of SPA-2	J1R098	151223.7	573817.8	
Equipment blank	J1R085	NA	NA	ICP metals [a], mercury

[a] The expanded list of ICP metals include antimony, arsenic, barium, beryllium, boron, cadmium, chromium(total), cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc in the analytical results package.

[b] A focused sample was collected from the 100-D-50:9 subsite, service area 2, in the northernmost excavation where no pipe was found to be present.

EXC = excavation area
GEA = gamma energy analysis
HEIS = Hanford Environmental Information System
ICP = inductively coupled plasma
NA = not applicable
OB = overburden area
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyl
SPA = staging pile area

VERIFICATION SAMPLING ACTIVITIES

Verification sampling was conducted at the 100-D-50:9 subsite, service area 2 on August 22 and 23, 2012. Sampling was conducted to support a determination that residual contaminant concentrations in the soil meet cleanup criteria specified in the RDR/RAWP (DOE-RL 2009b).

The verification sample results are provided in Appendix B and indicate that the waste removal action achieved compliance with the remedial action objectives (RAOs) and RAGs for the 100-D-50:9 subsite, service area 2. The following subsections provide additional discussion of the information used to develop the verification sampling design. The statistical results of verification sampling are also summarized to support interim closure of the site. A more detailed discussion of the verification sampling can be found in the *Work Instruction for Verification Sampling of the 100-D-50:9, 1607-DR3 Sanitary Sewer Pipelines* (WCH 2012b).

Contaminants of Potential Concern for Verification Sampling

The COPCs for the 100-D-50:9 subsite, service area 2 were identified based on existing historical information and possible uses of the site. The COPC list identified in the SAP (DOE-RL 2009a) includes cobalt-60, cesium-137, europium-152, europium-154, strontium-90, lead, hexavalent chromium, arsenic, barium, cadmium, chromium (total), mercury, selenium, and silver. The confirmatory work instruction (WCH 2005d) indicated that previous investigations of sanitary waste systems have shown the presence of constituents unrelated to sanitary sewage; therefore, PCBs, pesticides, and SVOCs were added as COPCs for the confirmatory samples. Additionally, americium-241, europium-155, plutonium-239/240, and total uranium were included in the confirmatory work instruction to address the possibility of nondesign waste loading.

Since PCBs and pesticides were detected above RAGs during confirmatory sampling, they were retained as COPCs for the site. Several polycyclic aromatic hydrocarbon (PAH) constituents in the semivolatile organic analysis (SVOA) were detected above RAGs; therefore, they were included as COPCs for the site. Bis(2-ethylhexyl) phthalate, butylbenzylphthalate, and di-n-butylphthalate were the only non-PAH constituents detected in the SVOA for service area 2, and they were detected at concentrations well below the RAGs. Since phthalates are common laboratory contaminants, these detections should be attributed to laboratory contamination rather than to field samples. Therefore, SVOA method 8270 was eliminated and replaced with PAH method 8310 for the verification soil samples. Carbozole was detected below the RAG in a sample collected from service area 1. Carbozole is not a COPC for service area 2.

The presence of strontium-90 and plutonium-239/240 was investigated by performing gross alpha and gross beta analysis for the confirmatory samples. The gross alpha and gross beta results did not detect activities greater than background (15 pCi/g and 23 pCi/g, respectively); therefore, additional analyses for strontium-90 and isotopic plutonium were not requested. Strontium-90 and plutonium-239/240 were eliminated as site COPCs. Americium-241, cobalt-60, europium-152, europium-154, and europium-155 were all undetected in the confirmatory samples; therefore, they were eliminated as COPCs for the site. Although total uranium was detected in the confirmatory samples, it was detected well below Hanford Site background and was therefore eliminated as a COPC for the site.

Field screening for volatile organic compounds was performed during sampling to assess the need for volatile organic analysis. Because no volatile organic compounds were detected in the field, volatile organic analysis was not included in the requested analyses for any of the samples and was not included as a COPC for the site. Similarly, asbestos-containing material was not identified during confirmatory sampling activities; therefore asbestos was not included as a site COPC.

Total petroleum hydrocarbon and herbicide analysis were inadvertently requested for the pipeline sediment confirmatory sample collected in service area 1. Since TPH was undetected, it will not be retained as a site COPC. 2,4-dichlorophenoxyacetic acid was the only constituent detected in the herbicide analysis. Since 2,4-dichlorophenoxyacetic acid was detected well below the RAG, herbicides was not retained as a COPC for this site.

The revised list of COPCs for the 100-D-50:9, 1607-DR Sanitary Sewer Pipelines subsite, service area 2 verification sampling included cesium-137, arsenic, barium, cadmium, chromium (total), lead, selenium, silver, mercury, hexavalent chromium, PAH, PCBs, and pesticides.

Verification Sampling Design

The statistical sampling design for the 100-D-50:9 subsite, service area 2 was developed using Visual Sample Plan[1] (VSP). The 100-D-50:9 subsite, service area 2 consists of three decision units: the excavation, the overburden soil stockpile, and the waste staging pile area. The decision units identified for the purpose of statistical verification sampling were delineated in VSP and used as the basis for a random-start systematic grid for verification soil sample collection at the site. Twelve statistical verification soil samples plus a duplicate sample were collected on the grid within each of the three decision units at the 100-D-50:9 subsite, service area 2. One focused sample was collected from the center of the north pit below where the northernmost portion of the 100-D-50:9 pipe was expected but not found. All sampling was performed in accordance with ENV-1, *Environmental Monitoring & Management*, to fulfill the requirements of the *100 Area Remedial Action Sampling and Analysis Plan* (DOE-RL 2009a). All samples were grab samples collected at the predetermined coordinates. Additional information related to verification sampling can be found in the field sampling logbook (WCH 2012a). The verification sample summary is provided in Table 4. Figures 6, 7, and 8 show the footprints and the sampling locations for each decision unit.

Verification Sampling Results

All verification samples were analyzed using EPA-approved analytical methods. Evaluation of the verification data from the 100-D-50:9 subsite, service area 2 was performed by direct comparison of the statistical or maximum sample results for each COPC against cleanup criteria.

[1] Visual Sample Plan is a site map-based user-interface program that may be downloaded at http://vsp.pnnl.gov.

Figure 6. Verification Sample Locations for the 100-D-50:9 Service Area 2 (All Locations).

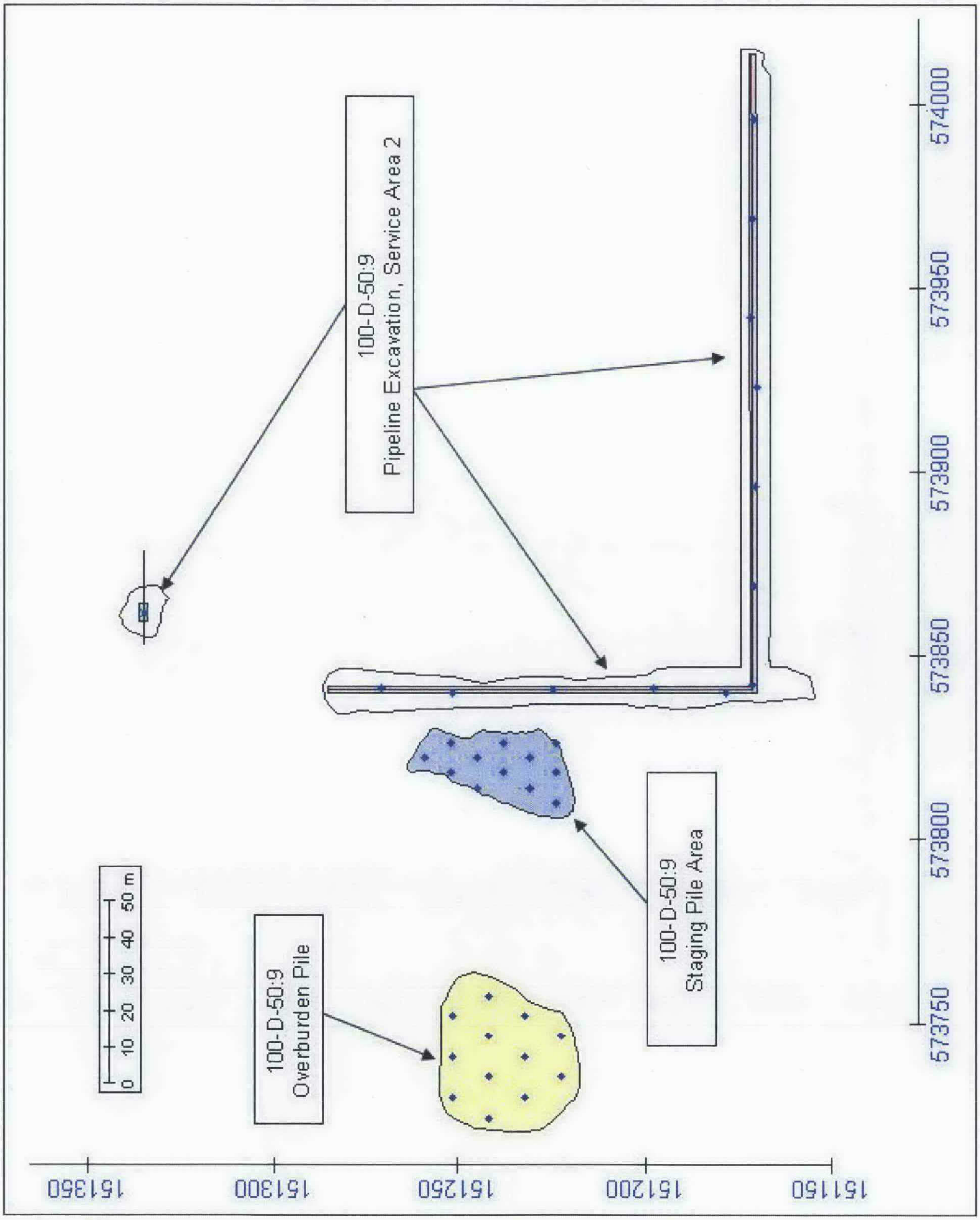


Figure 7. Verification Sample Locations for the 100-D-50:9 Service Area 2 Excavations.

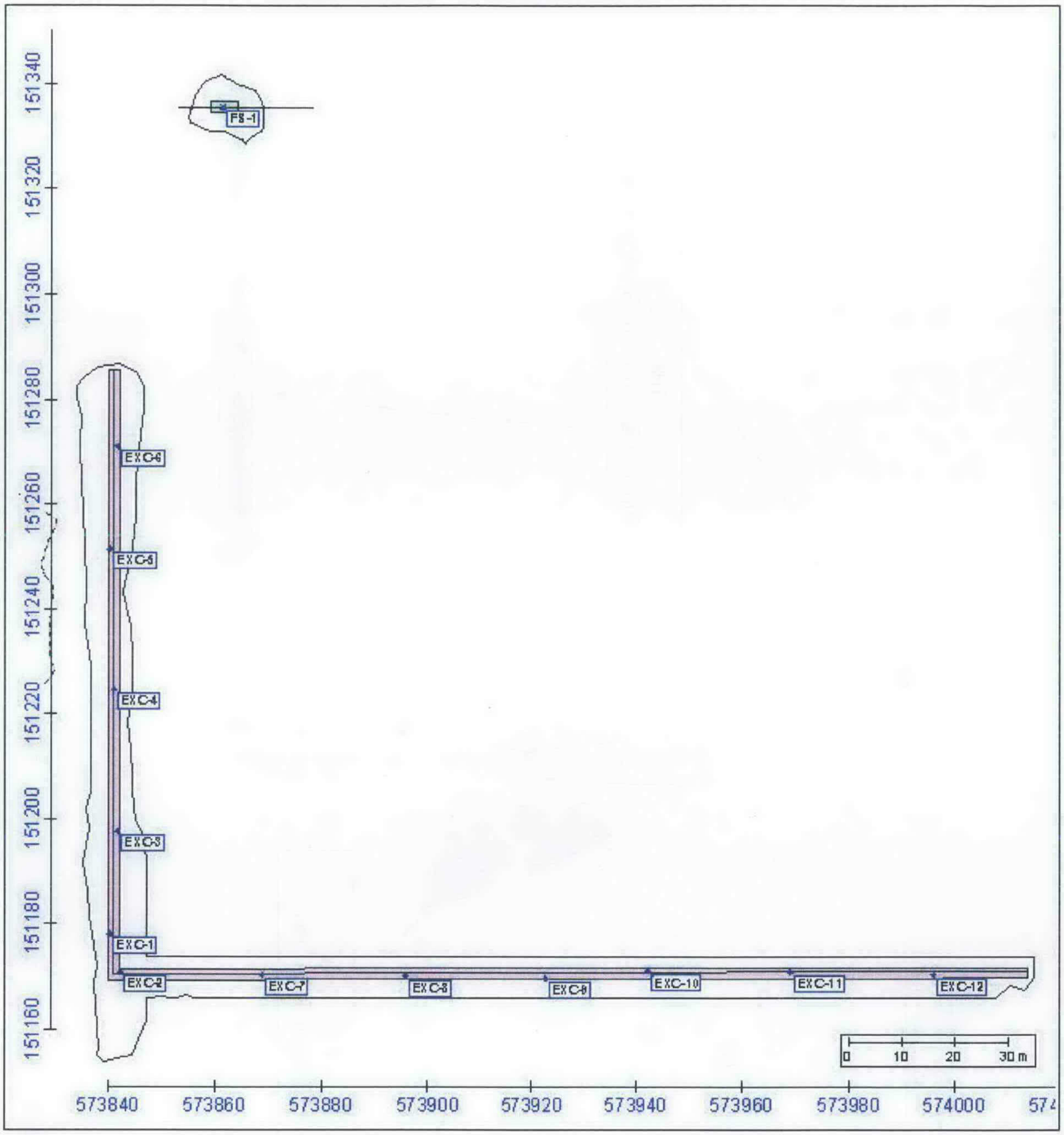
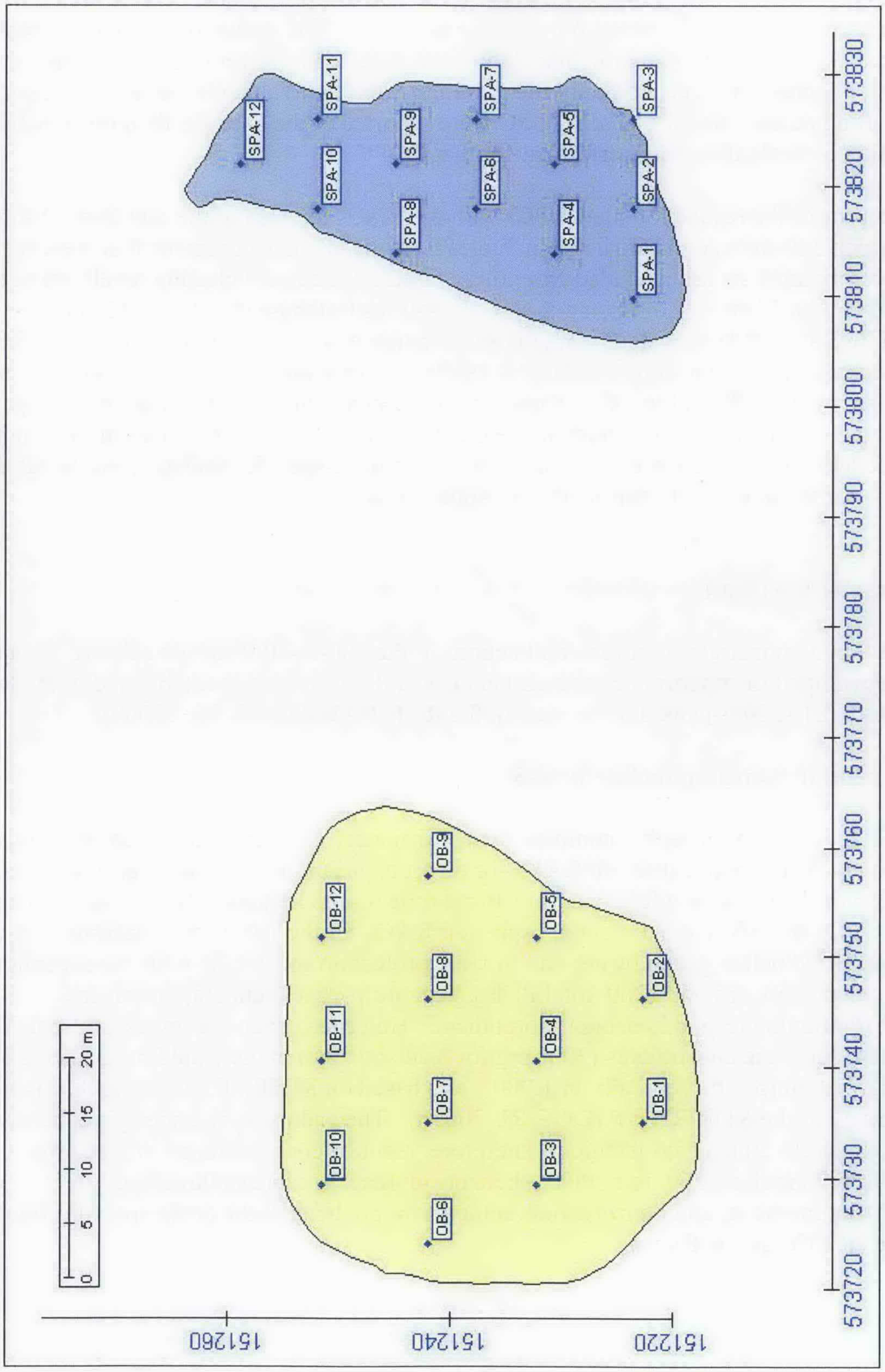


Figure 8. Verification Sample Locations for the 100-D-50:9 Service Area 2 Overburden Pile and Staging Pile Area.



The primary statistical calculation to evaluate compliance with cleanup standards is the 95% upper confidence limit (UCL) on the arithmetic mean of the data. The 95% UCL values for each detected COPC are computed for each of the 100-D-50:9 subsite, service area 2 decision units as specified by the RDR/RAWP (DOE-RL 2009b). The calculations are provided in Appendix B. When a nonradionuclide COPC was detected in fewer than 50% of the verification samples collected for a decision unit, the maximum detected value was used for comparison to RAGs. If no detections for a given COPC were reported in the data set, then no statistical calculation or evaluation was performed for that COPC.

Comparisons of the results for site COPCs with the RAGs for each of the 100-D-50:9 subsite, service area 2 decision units are listed in Tables 5 through 8. Contaminants that were not detected by laboratory analysis are excluded from these tables. Calculated cleanup levels are not presented in the Cleanup Levels and Risk Calculations Database (Ecology 2012) under WAC 173-340-740(3) for calcium, magnesium, potassium, silicon, and sodium. The EPA's *Risk Assessment Guidance for Superfund* (EPA 1989) recommends that aluminum and iron not be considered in site risk evaluations. Therefore, aluminum, calcium, iron, magnesium, potassium, silicon, and sodium are not considered site COPCs and are also not included in these tables. The complete laboratory results are stored in the ENRE project-specific database prior to submitting to the HEIS for archiving and are provided in Appendix B.

DATA EVALUATION

This section demonstrates that remedial actions at the 100-D-50:9 subsite achieve the applicable RAGs developed to support unrestricted land use at the 100 Area as established in the Remaining Sites ROD (EPA 1999) and documented in the RDR/RAWP (DOE-RL 2009b).

Attainment of Nonradionuclide RAGS

Tables 2 and 3 and 5 through 8 compare the confirmatory and verification sample values, respectively, to the applicable soil RAGs for direct exposure, protection of groundwater, and protection of the Columbia River. Evaluation of the results indicates that residual concentrations of all COPCs are below the direct exposure soil RAGs for the 100-D-50:9 subsite. All COPCs were quantified below groundwater and/or river protection soil RAGs with the exception of lead, zinc, aroclor-1254, aroclor-1260, total PCBs, benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, and benzo(k)fluoranthene. However, given the lowest soil-partitioning coefficient for these constituents (30 mL/g for lead and zinc), none would be expected to migrate more than 1.8 m (5.9 ft) vertically in 1,000 years based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b). The vadose zone underlying the excavation is approximately 20 m (65.6 ft) thick. Therefore, residual concentrations of lead, zinc, aroclor-1254, aroclor-1260, total PCBs, benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, and benzo(k)fluoranthene are predicted to be protective of groundwater (and thus the Columbia River).

Table 5. Comparison of Statistical Samples Contaminant Concentrations to Action Levels for the 100-D-50:9 Subsite, Service Area 2 Excavation Verification Sampling. (2 Pages)

COPC	Statistical or Maximum Result [b] (pCi/g)	Generic Site Lookup Values [a] (pCi/g)			Does the Result Exceed Lookup Values?	Does the Result Pass RESRAD Modeling?
		Shallow Zone Lookup Value	Groundwater Protection Lookup Value	River Protection Lookup Value		
Cesium-137	0.0215 (<BG)	6.2	1,465	2,930	No	--
COPC	**Statistical or Maximum Result [b] (mg/kg)**	**Remedial Action Goals [a] (mg/kg)**			**Does the Result Exceed RAGs?**	**Does the Result Pass RESRAD Modeling?**
		Direct Exposure	**Soil Cleanup Level for Groundwater Protection**	**Soil Cleanup Level for River Protection**		
Antimony [c]	0.66 (<BG)	32	5 [d]	5 [d]	No	--
Arsenic	2.3 (<BG)	20 [d]	20 [d]	20 [d]	No	--
Barium	72.5 (<BG)	5,600	200	400	No	--
Beryllium	0.49 (<BG)	10.4 [e]	1.51 [d]	1.51 [d]	No	--
Boron [f]	1.3	7,200	320	-- [g]	No	--
Cadmium [c]	0.097 (<BG)	13.9 [e]	0.81 [d]	0.81 [d]	No	--
Chromium (total)	11.2 (<BG)	80,000	18.5 [d]	18.5 [d]	No	--
Cobalt	8.1 (<BG)	24	15.7 [d]	-- [g]	No	--
Copper	15.7 (<BG)	2,960	59.2	22.0 [d]	No	--
Hexavalent chromium [f]	0.265	2.1 [e]	4.8	2	No	--
Lead	9.1 (<BG)	353	10.2 [d]	10.2 [d]	No	--
Manganese	330 (<BG)	3,760	512 [d]	512 [d]	No	--
Molybdenum [f]	0.32	400	8	-- [g]	No	--
Nickel	11.9 (<BG)	1,600	19.1 [d]	27.4	No	--
Vanadium	53.5 (<BG)	560	85.1 [d]	-- [g]	No	--
Zinc	40.2 (<BG)	24,000	480	67.8 [d]	No	--
Benzo(a)anthracene	0.015	1.37	0.015 [h]	0.015 [h]	Yes	Yes [i]
Benzo(a)pyrene	0.024	0.137	0.015 [h]	0.015 [h]	Yes	Yes [i]
Benzo(b)fluoranthene	0.066	1.37	0.015 [h]	0.015 [h]	Yes	Yes [i]
Benzo(ghi)perylene [j]	0.040	2,400	48	192	No	--
Benzo(k)fluoranthene	0.019	1.37	0.015 [h]	0.015 [h]	Yes	Yes [i]
Chrysene	0.068	13.7	0.12	0.1 [h]	No	--

Table 5. Comparison of Statistical Samples Contaminant Concentrations to Action Levels for the 100-D-50:9 Subsite, Service Area 2 Excavation Verification Sampling. (2 Pages)

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a] (mg/kg)			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Indeno(1,2,3-cd)pyrene	0.039	1.37	0.33 [h]	0.33 [h]	No	No

[a] Lookup values and RAGs obtained from the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2009b), unless otherwise noted.

[b] Maximum or 95% UCL result, depending on data censorship, as described in the *100-D-50:9 Subsite Service Area 2 Cleanup Verification 95% UCL Calculation* (Appendix B).

[c] Hanford Site-specific background not available. Value is Washington State background from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

[d] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (Ecology 1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement Project Managers as discussed in Section 2.1.2.1 of the RDR/RAWP (DOE-RL 2009b).

[e] Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340-750[3] (Ecology 1996) using an airborne particulate mass-loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).

[f] No Hanford Site-specific or Washington State BG value is available.

[g] No parameters (bioconcentration factors or ambient water quality criteria values) are available from the Ecology Cleanup Levels and Risk Calculations database (Ecology 2012) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [Ecology 1996] [Method B for surface waters]).

[h] Where cleanup levels are less than RDLs, cleanup levels default to RDLs per WAC 173-340-707(2) (Ecology 1996). The cited RDLs are based on EPA-approved analytical methods that may not be available for rapid-turnaround analyses.

[i] Because the soil-partitioning coefficient values for benzo(a)pyrene, benzo(b)fluoranthene, and benzo(k)fluoranthene are greater than 80 mL/g (969 mL/g, 803 mL/g, and 1,230 mL/g respectively), RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b) predicts the contaminants will not migrate to groundwater within 1,000 years. The vadose zone beneath the 100-D-50:9 excavation is approximately 20 m (65.6 ft) thick. Based on RESRAD modeling, constituents with a soil-partitioning coefficient of 3.6 mL/g or greater are not predicted to migrate through a vadose zone of this thickness and reach groundwater in 1,000 years. Therefore, residual concentrations of benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3-cd)pyrene (with soil-partitioning coefficients greater than 803 mL/g) are predicted to be protective of groundwater and the Columbia River.

[j] Toxicity data for this chemical are not available. Cleanup levels are based on surrogate chemicals: contaminant: benzo(ghi)perylene; surrogate: pyrene.

-- = not applicable
BG = background
COPC = contaminant of potential concern
EPA = U.S. Environmental Protection Agency
RAG = remedial action goal
RDL = required detection limit
RDR/RAWP = *Remedial Design Report/Remedial Action Work Plan for the 100 Area*
RESRAD = RESidual RADioactivity (dose model)
UCL = upper confidence limit
WAC = *Washington Administrative Code*

Table 6. Comparison of Statistical Samples Contaminant Concentrations to Action Levels for the 100-D-50:9 Subsite, Service Area 2 Overburden Verification Sampling. (2 Pages)

COPC	Statistical or Maximum Result [b] (pCi/g)	Generic Site Lookup Values [a] (pCi/g)			Does the Result Exceed Lookup Values?	Does the Result Pass RESRAD Modeling?
		Shallow Zone Lookup Value	Groundwater Protection Lookup Value	River Protection Lookup Value		
Cesium-137	0.0360 (<BG)	6.2	1,465	2,930	No	--
Europium-155	0.0416 (<BG)	125	-- [c]	-- [c]	No	--
COPC	**Statistical or Maximum Result [b] (mg/kg)**	**Remedial Action Goals [a] (mg/kg)**			**Does the Result Exceed RAGs?**	**Does the Result Pass RESRAD Modeling?**
		Direct Exposure	**Soil Cleanup Level for Groundwater Protection**	**Soil Cleanup Level for River Protection**		
Antimony [d]	0.49 (<BG)	32	5 [e]	5 [e]	No	--
Arsenic	2.6 (<BG)	20 [e]	20 [e]	20 [e]	No	--
Barium	65.8 (<BG)	5,600	200	400	No	--
Beryllium	0.13 (<BG)	10.4 [f]	1.51 [e]	1.51 [e]	No	--
Boron [g]	1.1	7,200	320	-- [h]	No	--
Cadmium [d]	0.038 (<BG)	13.9 [f]	0.81 [e]	0.81 [e]	No	--
Chromium (total)	10.4 (<BG)	80,000	18.5 [e]	18.5 [e]	No	--
Cobalt	8.2 (<BG)	24	15.7 [e]	-- [h]	No	--
Copper	16.5 (<BG)	2,960	59.2	22.0 [e]	No	--
Hexavalent chromium [g]	0.258	2.1 [f]	4.8	2	No	--
Lead	16.0	353	10.2 [e]	10.2 [e]	Yes	Yes [i]
Manganese	319 (<BG)	3,760	512 [e]	512 [e]	No	--
Molybdenum [g]	0.29	400	8	-- [h]	No	--
Nickel	11.7 (<BG)	1,600	19.1 [e]	27.4	No	--
Vanadium	54.5 (<BG)	560	85.1 [e]	-- [h]	No	--
Zinc	43.4 (<BG)	24,000	480	67.8 [e]	No	--
Benzo(a)anthracene	0.0059	1.37	0.015 [j]	0.015 [j]	No	--
Benzo(b)fluoranthene	0.015	1.37	0.015 [j]	0.015 [j]	Yes	Yes [i]
Benzo(ghi)perylene [k]	0.026	2,400	48	192	No	--
Chrysene	0.010	13.7	0.12	0.1 [j]	No	--
Fluoranthene	0.023	3,200	64	18.0	No	--

Table 6. Comparison of Statistical Samples Contaminant Concentrations to Action Levels for the 100-D-50:9 Subsite, Service Area 2 Overburden Verification Sampling. (2 Pages)

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a] (mg/kg)			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Indeno(1,2,3-cd)pyrene	0.013	1.37	0.033 [j]	0.033 [j]	No	--
Pyrene	0.020	2,400	48	192	No	--

[a] Lookup values and RAGs obtained from the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2009b), unless otherwise noted.

[b] Maximum or 95% UCL result, depending on data censorship, as described in the *100-D-50:9 Subsite Service Area 2 Cleanup Verification 95% UCL Calculation* (Appendix B).

[c] No value; because the soil partitioning coefficient value is greater than 80 mL/g, RESRAD modeling, discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), predicts the contaminants will not reach groundwater within 1,000 years.

[d] Hanford Site-specific background not available. Value is Washington State background from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

[e] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (Ecology 1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement Project Managers as discussed in Section 2.1.2.1 of the RDR/RAWP (DOE-RL 2009b).

[f] Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340-750[3] (Ecology 1996) using an airborne particulate mass-loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).

[g] No Hanford Site-specific or Washington State BG value is available.

[h] No parameters (bioconcentration factors or ambient water quality criteria values) are available from the Ecology Cleanup Levels and Risk Calculations database (Ecology 2012) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii], (Ecology 1996) [Method B for surface waters]).

[i] Based on the RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), residual concentrations of benzo(b)fluoranthene and lead are not expected to migrate more than 1.8 m (5.9 ft) vertically in 1,000 years (based on the lowest distribution coefficient of the constituents [lead] of 30 mL/g). The vadose zone underlying the excavation is approximately 20 m (65.6 ft) thick. Therefore, residual concentrations of lead are predicted to be protective of groundwater and the Columbia River.

[j] Where cleanup levels are less than RDLs, cleanup levels default to RDLs per WAC 173-340-707(2) (Ecology 1996). The cited RDLs are based on EPA-approved analytical methods that may not be available for rapid-turnaround analyses.

[k] Toxicity data for this chemical are not available. Cleanup levels are based on surrogate chemicals: contaminant: benzo(ghi)perylene; surrogate: pyrene

-- = not applicable
BG = background
COPC = contaminant of potential concern
EPA = U.S. Environmental Protection Agency
RAG = remedial action goal
RDL = required detection limit
RDR/RAWP = *Remedial Design Report/Remedial Action Work Plan for the 100 Area*
RESRAD = RESidual RADioactivity (dose model)
UCL = upper confidence limit
WAC = *Washington Administrative Code*

Table 7. Comparison of Statistical Samples Contaminant Concentrations to Action Levels for the 100-D-50:9 Subsite, Service Area 2 Staging Pile Area Verification Sampling. (2 Pages)

COPC	Statistical or Maximum Result [b] (pCi/g)	Generic Site Lookup Values [a] (pCi/g)			Does the Result Exceed Lookup Values?	Does the Result Pass RESRAD Modeling?
		Shallow Zone Lookup Value	Groundwater Protection Lookup Value	River Protection Lookup Value		
Cesium-137	0.0260 (<BG)	6.2	1,465	2,930	No	--
Europium-155	0.0473 (<BG)	125	-- [c]	-- [c]	No	--
COPC	**Statistical or Maximum Result [b] (mg/kg)**	**Remedial Action Goals [a] (mg/kg)**			**Does the Result Exceed RAGs?**	**Does the Result Pass RESRAD Modeling?**
		Direct Exposure	**Soil Cleanup Level for Groundwater Protection**	**Soil Cleanup Level for River Protection**		
Antimony [d]	0.93 (<BG)	32	5 [e]	5 [e]	No	--
Arsenic	2.7 (<BG)	20 [e]	20 [e]	20 [e]	No	--
Barium	66.6 (<BG)	5,600	200	400	No	--
Beryllium	0.093 (<BG)	10.4 [f]	1.51 [e]	1.51 [e]	No	--
Boron [g]	1.6	7,200	320	-- [h]	No	--
Cadmium [d]	0.046 (<BG)	13.9 [f]	0.81 [e]	0.81 [e]	No	--
Chromium (total)	10.0 (<BG)	80,000	18.5 [e]	18.5 [e]	No	--
Cobalt	8.8 (<BG)	24	15.7 [e]	-- [h]	No	--
Copper	17.3 (<BG)	2,960	59.2	22.0 [e]	No	--
Hexavalent chromium	0.693	2.1 [f]	4.8	2	No	--
Lead	15.3	353	10.2 [e]	10.2 [e]	Yes	Yes [i]
Manganese	333 (<BG)	3,760	512 [e]	512 [e]	No	--
Mercury	0.030 (<BG)	24	0.33 [e]	0.33 [e]	No	--
Molybdenum [g]	0.30	400	8	-- [h]	No	--
Nickel	11.9 (<BG)	1,600	19.1 [e]	27.4	No	--
Vanadium	59.4 (<BG)	560	85.1 [e]	-- [h]	No	--
Zinc	68.2	24,000	480	67.8 [e]	Yes	Yes [i]
Benzo(a)anthracene	0.014	1.37	0.015 [j]	0.015 [j]	No	--
Benzo(a)pyrene	0.0070	0.137	0.015 [j]	0.015 [j]	No	--
Benzo(b)fluoranthene	0.011	1.37	0.015 [j]	0.015 [j]	No	--
Chrysene	0.017	13.7	0.12	0.1 [j]	No	--
Fluoranthene	0.024	3,200	64	18.0	No	--
Phenanthrene [k]	0.026	24,000	240	1,920	No	--
Pyrene	0.030	2,400	48	192	No	--

Table 7. Comparison of Statistical Samples Contaminant Concentrations to Action Levels for the 100-D-50:9 Subsite, Service Area 2 Staging Pile Area Verification Sampling. (2 Pages)

COPC	Statistical or Maximum Result [b] (mg/kg)	Remedial Action Goals [a] (mg/kg)			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Aroclor-1254	0.030	0.5	0.017 [j]	0.017 [j]	Yes	Yes [i]
Aroclor-1260	0.027	0.5	0.017 [j]	0.017 [j]	Yes	Yes [i]
Total PCBs	0.057	0.5	0.017 [j]	0.017 [j]	Yes	Yes [i]
4,4'DDT	0.0019	2.94	0.0257	0.0033 [j]	No	--

[a] Lookup values and RAGs obtained from the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2009b), unless otherwise noted.

[b] Maximum or 95% UCL result, depending on data censorship, as described in the *100-D-50:9 Subsite Service Area 2 Cleanup Verification 95% UCL Calculation* (Appendix B).

[c] No value; because the soil partitioning coefficient value is greater than 80 mL/g, RESRAD modeling, discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), predicts the contaminants will not reach groundwater within 1,000 years.

[d] Hanford Site-specific background not available. Value is Washington State background from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

[e] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (Ecology 1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement Project Managers as discussed in Section 2.1.2.1 of the RDR/RAWP (DOE-RL 2009b).

[f] Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340-750[3] (Ecology 1996) using an airborne particulate mass-loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).

[g] No Hanford Site-specific or Washington State BG value is available.

[h] No parameters (bioconcentration factors or ambient water quality criteria values) are available from the Ecology Cleanup Levels and Risk Calculations database (Ecology 2012) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii], (Ecology 1996) [Method B for surface waters]).

[i] Based on the RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b), residual concentrations of lead, zinc, aroclor-1254, aroclo-1260, and total PCBs are not expected to migrate more than 1.8 m (5.9 ft) vertically in 1,000 years (based on the lowest distribution coefficient of the constituents [lead and zinc] of 30 mL/g). The vadose zone underlying the excavation is approximately 20 m (65.6 ft) thick. Therefore, residual concentrations of lead, zinc, aroclor-1254, aroclo-1260, and total PCBs are predicted to be protective of groundwater and the Columbia River.

[j] Where cleanup levels are less than RDLs, cleanup levels default to RDLs per WAC 173-340-707(2) (Ecology 1996). The cited RDLs are based on EPA-approved analytical methods that may not be available for rapid-turnaround analyses.

[k] Toxicity data for this chemical are not available. Cleanup levels are based on surrogate chemicals: contaminant: phenanthrene; surrogate: anthracene.

-- = not applicable
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDL = required detection limit
RDR/RAWP = *Remedial Design Report/Remedial Action Work Plan for the 100 Area*
RESRAD = RESidual RADioactivity (dose model)
PCB = polychlorinated biphenyls
UCL = upper confidence limit
WAC = *Washington Administrative Code*

Table 8. Comparison of Maximum Samples Contaminant Concentrations to Action Levels for the 100-D-50:9 Focused Verification Sampling.

COPC	Maximum Result [b] (mg/kg)	Remedial Action Goals [a] (mg/kg)			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Antimony [c]	0.44 (<BG)	32	5 [d]	5 [d]	No	--
Arsenic	1.8 (<BG)	20 [d]	20 [d]	20 [d]	No	--
Barium	60.7 (<BG)	5,600	200	400	No	--
Beryllium	0.50 (<BG)	10.4 [e]	1.51 [d]	1.51 [d]	No	--
Cadmium [c]	0.096 (<BG)	13.9 [e]	0.81 [d]	0.81 [d]	No	--
Chromium (total)	8.2 (<BG)	80,000	18.5 [d]	18.5 [d]	No	--
Cobalt	8.5 (<BG)	24	15.7 [d]	-- [f]	No	--
Copper	15.8 (<BG)	2,960	59.2	22.0 [d]	No	--
Lead	3.7 (<BG)	353	10.2 [d]	10.2 [d]	No	--
Manganese	319 (<BG)	3,760	512 [d]	512 [d]	No	--
Nickel	10.0 (<BG)	1,600	19.1 [d]	27.4	No	--
Vanadium	59.8 (<BG)	560	85.1 [d]	-- [f]	No	--
Zinc	40.9 (<BG)	24,000	480	67.8 [d]	No	--

[a] RAGs obtained from the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2009b), unless otherwise noted.
[b] Maximum or 95% UCL result, depending on data censorship, as described in the *100-D-50:9 Subsite Service Area 2 Cleanup Verification 95% UCL Calculation* (Appendix B).
[c] Hanford Site-specific background not available. Value is Washington State background from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).
[d] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700(4)(d) (Ecology 1996). The arsenic cleanup level of 20 mg/kg has been agreed to by the Tri-Party Agreement Project Managers as discussed in Section 2.1.2.1 of the RDR/RAWP (DOE-RL 2009b).
[e] Carcinogenic cleanup level calculated based on the inhalation exposure pathway (WAC 173-340-750[3]) (Ecology 1996) using an airborne particulate mass-loading rate of 0.0001 g/m^3 (*Hanford Guidance for Radiological Cleanup* [WDOH 1997]).
[f] No parameters (bioconcentration factors or ambient water quality criteria values) are available from the Ecology Cleanup Levels and Risk Calculations database (Ecology 2012) or other databases to calculate cleanup levels (WAC 173-340-730[3][a][iii] [Ecology 1996] [Method B for surface waters]).

-- = not applicable
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RDL = required detection limit
RDR/RAWP = *Remedial Design Report/Remedial Action Work Plan for the 100 Area*
RESRAD = RESidual RADioactivity (dose model)
UCL = upper confidence limit
WAC = *Washington Administrative Code*

Three-Part Test for Nonradionuclides

A RAG requirement for nonradionuclides is the WAC 173-340-740(7)(e) three-part test, which consists of the following criteria: (1) the cleanup verification 95% UCL value must be less than the cleanup level, (2) no single detection shall exceed two times the cleanup criteria, and (3) the percentage of samples exceeding the cleanup criteria must be less than 10% of the data set.

The application of the three-part test for the 100-D-50:9 subsite is included in the statistical calculations, where half or more of the data set was detected (Appendix B). The results of this evaluation indicate that residual COPC concentrations pass the three-part test in comparison against applicable RAGs, with the exception of lead and zinc, which fail one or more parts of the three-part test. However, the residual concentrations of these constituents are not expected to migrate more than 1.8 m (5.9 ft) vertically in 1,000 years, based on the lowest distribution coefficient of the contaminants (lead and zinc) of 30 mL/g. With approximately 20 m (65.6 ft) of vadose zone below the site, the residual concentrations of COPCs are predicted to be protective of groundwater and the Columbia River.

An additional application of the three-part test is included for the statistical data sets that default to the maximum because less than half of the data set was detected. The results of this evaluation indicate that residual COPC concentrations pass the three-part test in comparison against applicable RAGs, except for benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, aroclor-1254, and aroclor-1260, which fail one or more parts of the three-part test. However, the residual concentrations of these constituents are predicted to migrate less than 1 m (3.3 ft) vertically in 1,000 years based on the lowest soil-partitioning coefficient of 75.6 mL/g for aroclor-1254. Therefore, residual concentrations of all COPCs are predicted to be protective of groundwater and the Columbia River.

Nonradionuclide Direct Contact Hazard Quotient and Carcinogenic Risk RAGs Attained

Nonradionuclide risk requirements include an individual hazard quotient of less than 1.0, a cumulative hazard quotient of less than 1.0, an individual contaminant carcinogenic risk of less than 1×10^{-6}, and a cumulative carcinogenic risk of less than 1×10^{-5}. For the 100-D-50:9 subsite, these risk values were calculated separately for service area 1 and service area 2. The risk values were not calculated for constituents that were either not detected or were detected at concentrations below Hanford Site or Washington State background.

All individual hazard quotients for noncarcinogenic constituents were less than 1.0 for both service areas 1 and 2. The cumulative hazard quotient for those noncarcinogenic constituents above background or detected levels is 2.5×10^{-3} and 2.6×10^{-2} for service areas 1 and 2, respectively. The individual carcinogenic risk values for the carcinogenic constituents detected above background for both service areas are less than 1×10^{-6}, and the cumulative carcinogenic risk value is 1.4×10^{-7} and 7.3×10^{-7} for service areas 1 and 2, respectively, which are less than 1×10^{-5}. The 100-D-50:9 subsite meets the requirements for the direct contact hazard quotient and excess carcinogenic risk as identified in the RDR/RAWP (DOE-RL 2009b).

Nonradionuclide Groundwater Hazard Quotient and Carcinogenic Risk RAGs Attained

Assessment of the risk requirements for the 100-D-50:9 subsite included calculation of the hazard quotient and carcinogenic (excess cancer) risk values for groundwater protection for nonradionuclides. The requirements include an individual and cumulative hazard quotient of less than 1.0, an individual excess carcinogenic risk of less than 1×10^{-6}, and a cumulative excess carcinogenic risk of less than 1×10^{-5}. For the 100-D-50:9 subsite, these risk values were calculated separately for service area 1 and service area 2. Risk values were calculated for constituents that were detected at concentrations above Hanford Site or Washington State background values or for which there is no background value. In addition, the distribution coefficients for these contaminants must be less than that necessary to show no migration to groundwater in 1,000 years based on RESRAD modeling discussed in Appendix C of the RDR/RAWP (DOE-RL 2009b). Based on this model and a vadose zone of approximately 20 m

(65.6 ft) in thickness at the excavation, a distribution coefficient of 3.7 or greater is required to show no predicted migration to groundwater within 1,000 years.

All individual hazard quotients for noncarcinogenic constituents are less than 1.0 for both service area 1 and 2. The cumulative hazard quotients are 6.3 x 10^{-2} and 1.5 x 10^{-1} for service area 1 and 2, respectively, which is less than 1.0. No carcinogenic constituents met the criteria for evaluation of groundwater risk protection at the 100-D-50:9 subsite, service area 1 or 2; therefore, no calculations of excess carcinogenic risk were performed. Nonradionuclide risk requirements related to groundwater are met for the 100-D-50:9 subsite.

Attainment of Radionuclide Direct Exposure RAGs

Evaluation of the radionuclide cleanup verification results in Tables 5, 6, and 7 indicates that all sample results were below lookup values.

Table 9 compares the radionuclide cleanup verification results from the excavation, overburden soil stockpile, and waste staging pile area footprint samples to direct exposure single radionuclide 15 mrem/yr dose-equivalence values and shows the sum-of-fractions evaluation for comparison of the total radionuclide dose to the RAG of 15 mrem/yr above background. The model used to develop these dose-equivalence lookup values is presented in the RDR/RAWP (DOE-RL 2009b). No sum-of-fractions evaluation was necessary for the confirmatory soil samples, as the radionuclides were undetected in samples collected from test pit 1 and test pit 4.

Table 9. Attainment of Radionuclide Direct Exposure Remedial Action Goals Verification Soil Sampling.

COPC	95% UCL Statistical Values (pCi/g)			Activity Equivalent to 15 mrem/yr Dose [a] (pCi/g)	Fraction		
	Excavation	SPA	Overburden Soil Stockpile		Excavation	SPA	Overburden Soil Stockpile
Cesium-137	0.0215	0.0260	0.0360	6.2	0.0035	0.0042	0.0058
Europium-155	--	0.0473	0.0416	125	--	0.0004	0.0003
				Total	0.0035	0.0046	0.0061
				Equivalent Dose (mrem/yr)	0.0525	0.069	0.0915

[a] Single radionuclide 15 mrem/yr dose-equivalence values and derivation methodology are presented in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2009b).

-- = not applicable
COPC = contaminant of potential concern
SPA = staging pile area
UCL = upper confidence limit

Potassium-40, radium-226, radium-228, thorium-228, and thorium-232 were detected in samples collected at the site but are not considered in the statistical calculations. These isotopes are excluded from consideration based on natural occurrence and were all detected below background levels (based on an assumption of secular equilibrium, the background activities for radium-228 and thorium-228 are equal to the statistical background activity of 1.32 pCi/g for thorium-232) (DOE-RL 2009b).

The four columns on the left side of Table 9 are the COPCs and the radionuclide activities for the samples. The fifth column presents the single radionuclide 15 mrem/yr dose-equivalence activities, and the last three columns present the radionuclide activities divided by the dose-equivalence activities. As demonstrated by the summation of the fractions for each decision unit, the maximum cumulative dose values contributed by the residual radionuclide populations are predicted to be less than the RAG of 15 mrem/yr above background. The maximum cumulative dose rate for the waste site (from the overburden soil stockpile) is 0.0915 mrem/yr.

DATA QUALITY ASSESSMENT

A data quality assessment (DQA) was performed to compare the confirmatory and verification sampling approaches (WCH 2005d, 2012b), the field logbooks (WCH 2005a, 2005b, 2005c, and WCH 2012a), and resulting analytical data with the sampling and data quality requirements specified by the project objectives and performance specifications.

The DQA for the 100-D-50:9 subsite established that the data are of the right type, quality, and quantity to support site verification decisions within specified error tolerances. The evaluation verified that the sample design was sufficient for the purpose of clean site verification. The cleanup verification sample analytical data are stored in the ENRE project-specific database for data evaluation prior to its archival in the HEIS and are summarized in Appendix B. The detailed DQAs are presented in Appendix C.

SUMMARY FOR INTERIM CLOSURE

The 100-D-50:9 subsite has been evaluated in accordance with the Remaining Sites ROD (EPA 1999) and the RDR/RAWP (DOE-RL 2009b). Verification sampling was performed, and the analytical results indicate that the residual concentrations of COPCs at these waste sites meet the RAOs for direct exposure, groundwater protection, and river protection. In accordance with this evaluation, the confirmatory sampling and verification sampling results support a reclassification of the 100-D-50:9 subsite to Interim Closed Out. Contamination above direct exposure levels was not observed in shallow zone soils and is concluded to not exist in deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required.

REFERENCES

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WCH, 2005c, *Remaining Sites Field Sampling*, Logbook EL-1578-9, pp. 13-18, Washington Closure Hanford, Richland, Washington.

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APPENDIX A

ECOLOGICAL RISK COMPARISON TABLE

Table A-1. Maximum Contaminant Concentrations that Exceed Ecological Screening Levels for the 100-D-50:9 Subsite [a].

Hazardous Substance	Background (mg/kg)	Waste Site Statistical or Maximum Result [c] (mg/kg)	2007 WAC 173-340 Table 749-3			EPA Ecological Soil Screening Levels [b]			
			Plants (mg/kg)	Soil Biota (mg/kg)	Wildlife (mg/kg)	Plants (mg/kg)	Soil Biota (mg/kg)	Avian [d] (mg/kg)	Mammalian [d] (mg/kg)
Metals									
Antimony	5	0.93 (<BG)	5	--	--	--	78	--	0.27
Boron	--	1.6	0.5	--	--	--	--	--	--
Lead	10.2	16.0	50	500	118	120	1,700	11	56
Manganese	512	337 (<BG)	1,100 [e]	--	1,500	220	450	4,300	4,000
Vanadium	85.1	59.8 (<BG)	2	--	--	--	--	7.8	280
Zinc	67.8	68.2	86 [e]	200	360	160	120	46	79

NOTE. Shaded cells indicate screening values that are exceeded.

[a] Exceedance of screening values does not necessarily indicate the existence of risk to ecological receptors. All exceedances must be evaluated in the context of additional lines of evidence for ecological effects following a baseline risk assessment for the river corridor portion of the Hanford Site which will include a more complete quantitative ecological risk assessment.

[b] Available on the Internet at www.epa.gov/ecotox/ecossl.

[c] Value is the highest maximum or statistical result obtained from the 100-D-50:9 subsite service area 1 confirmatory soil sampling or service area 2 verification sampling.

[d] Wildlife.

[e] Benchmark replaced by Washington State natural background concentration from Ecology, 1994, *Natural Background Soil Metals Concentrations in Washington State*, Publication 94-115, Washington State Department of Ecology, Olympia, Washington.

-- = not available
BG = background
EPA = U.S. Environmental Protection Agency
WAC= *Washington Administrative Code*

APPENDIX B

CALCULATIONS

APPENDIX B

CALCULATIONS

The calculations in this appendix are kept in the active Washington Closure Hanford project files and are available upon request. When the project is completed, the files will be stored in a U.S. Department of Energy, Richland Operations Office, repository. The calculations have been prepared in accordance with ENG-1, *Engineering Services*, ENG-1-4.5, "Project Calculation," Washington Closure Hanford, Richland, Washington. The following calculations are provided in this appendix:

100-D-50:9 Subsite Service Area 2 Cleanup Verification 95% UCL Calculations, 0100D-CA-V0477, Rev. 0, Washington Closure Hanford, Richland, Washington.

100-D-50:9 Subsite Service Area 2 Direct Contact Hazard Quotient and Carcinogenic Risk Calculation, 0100D-CA-V0478, Rev. 0, Washington Closure Hanford, Richland, Washington.

100-D-50:9 Subsite Service Area 2 Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater, 0100D-CA-V0486, Rev. 0, Washington Closure Hanford, Richland, Washington.

100-D-50:9 Subsite Service Area 1 Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater, 0100D-CA-V0487, Rev. 0, Washington Closure Hanford, Richland, Washington.

100-D-50:9 Subsite Service Area 1 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations, 0100D-CA-V0488, Rev. 0, Washington Closure Hanford, Richland, Washington.

DISCLAIMER FOR CALCULATIONS

The calculations provided in this appendix have been generated to document compliance with established cleanup levels. These calculations should be used in conjunction with other relevant documents.

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CALCULATION COVER SHEET

Project Title: 100-D Field Remediation Job No. 14655

Area: 100-D

Discipline: Environmental *Calculation No: 0100D-CA-V0477

Subject: 100-D-50:9 Subsite Service Area 2 Cleanup Verification 95% UCL Calculation

Computer Program: Excel Program No: Excel 2003

The attached calculations have been generated to document compliance with established cleanup levels. These calculations should be used in conjunction with other relevant documents in the administrative record.

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Sheets = 26 Attm. 1 = 13 Total = 40	N. K. Schiffern N K Schiffern	J. D. Skoglie [signature]	C. H. Dobie C H Dobie	D. F. Obenauer D. F. Obenauer	1/24/13

SUMMARY OF REVISION

WCH-DE-018 (05/08/2007) *Obtain Calc. No. from Document Control and Form from Intranet

Washington Closure Hanford **CALCULATION SHEET**

Originator	N. K. Schiffern	**Date**	10/09/12	**Calc. No.**	0100D-CA-V0477	**Rev. No.**	0
Project	100-D Field Remediation	**Job No.**	14655	**Checked**	J. D. Skoglie	**Date**	10/09/12
Subject	100-D-50:9 Subsite Service Area 2 Cleanup Verification 95% UCL Calculations					**Sheet No.**	1 of 26

Summary

Purpose:
Calculate the 95% upper confidence limit (UCL) values to evaluate compliance with cleanup standards for the subject site. Also, perform the *Washington Administrative Code* (WAC) 173-340-740(7)(e) Model Toxics Control Act (MTCA) 3-part test for nonradionuclide analytes and calculate the relative percent difference (RPD) for primary-duplicate sample pairs for each contaminant of concern (COC) and contaminant of potential concern (COPC), as necessary.

Table of Contents:

Given/References:
1) Sample Results (Attachment 1).
2) DOE-RL, 2009a, *100 Area Remedial Action Sampling and Analysis Plan* (SAP), DOE/RL-96-22, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
3) DOE-RL, 2009b, *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP), DOE/RL-96-17, Rev. 6, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
4) Ecology, 1992, *Statistical Guidance for Ecology Site Managers*, Publication #92-54, Washington Department of Ecology, Olympia, Washington.
5) Ecology, 1993, *Statistical Guidance for Ecology Site Managers, Supplement S-6, Analyzing Site or Background Data with Below-detection Limit or Below-PQL Values (Censored Data Sets),* Publication #92-54, Washington Department of Ecology, Olympia, Washington.
6) Ecology, 2011, Cleanup Levels and Risk Calculations (CLARC) Database, Washington State Department of Ecology, Olympia, Washington, <https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx>.
7) EPA, 1989, *Risk Assessment Guidance for Superfund:* Volume 1, *Human Health Evaluation Manual, Part A; Interim Final,* EPA/540/1-89/002, U.S. Environmental Protection Agency, Washington, D. C.
8) WAC 173-340, 1996, "Model Toxic Control Act - Cleanup," *Washington Administrative Code.*

Solution:
Calculation methodology is described in Ecology Pub. #92-54 (Ecology 1992, 1993), below, and in the RDR/RAWP (DOE-RL 2009b). Use data from attached worksheets to perform the 95% UCL calculation for each analyte, the WAC 173-340-740(7)(e) 3-part test for nonradionuclides, and the RPD calculations for each COC/COPC. The hazard quotient and carcinogenic risk calculations are located in a separate calculation brief as an appendix to the Remaining Sites Verification Package (RSVP).

Calculation Description:
The subject calculations were performed on statistical data from soil verification samples (Attachment 1) from the Service Area 2 in the 100-D-50:9 subsite. The data were entered into an EXCEL 2003 spreadsheet and calculations performed by using the built-in spreadsheet functions and/or creating formulae within the cells. The statistical evaluation of data for use in accordance with the RDR/RAWP (DOE-RL 2009b) is documented by this calculation. Duplicate RPD results are used in evaluation of data quality within the RSVP for this site.

Methodology:
The Service Area 2 in the 100-D-50:9 subsite underwent statistical sampling. The Service Area 2 in the 100-D-50:9 subsite has three decision units for verification sampling, consisting of excavation, overburden, and staging pile area. Also taken was one focused sample.

Washington Closure Hanford **CALCULATION SHEET**

Originator	N. K. Schiffern	**Date**	10/09/12	**Calc. No.**	0100D-CA-V0477	**Rev. No.**	0
Project	100-D Field Remediation	**Job No.**	14655	**Checked**	J. D. Skoglie	**Date**	10/09/12
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Summary (continued)

Methodology, continued:

For nonradioactive analytes with $\leq$50% of the data below detection limits, the statistical value calculated to evaluate the effectiveness of cleanup is the 95% UCL. For nonradioactive analytes with >50% of the data below detection limits, as determined by direct inspection of the sample results (Attachment 1), the maximum detected value for the data set is used instead of the 95% UCL, and no further calculations are performed for those data sets. For convenience, these maximum detected values are included in the summary tables that follow. The 95% UCL was not calculated for data sets with no reported detections. Calculated cleanup levels are not available in Ecology (2011) under WAC 173-340-740(3) for calcium, magnesium, potassium, silicon, and sodium. The EPA's *Risk Assessment Guidance* for Superfund (EPA 1989) recommends that aluminum and iron not be considered in site risk evaluations. Therefore, aluminum, calcium, iron, magnesium, potassium, silicon, and sodium are not considered site COCs/COPCs and are also not included in these calculations. The 95% UCL values were not calculated for potassium-40, radium-226, radium-228, thorium-228, and thorium-232 based on natural occurence at the Hanford Site.

All nonradionuclide data reported as being undetected are set to ½ the detection limit value for calculation of the statistics (Ecology 1993). For the statistical evaluation of duplicate sample pairs, the samples are averaged before being included in the data set, after adjustments for censored data as described above. For radionuclide data, calculation of the statistics is done using the reported value. In cases where the laboratory does not report a value below the minimum detectable activity (MDA), half of the MDA is used in the calculation. For the statistical evaluation of duplicate sample pairs, the samples are averaged before being included in the data set, after adjustments for censored data as described above.

For nonradionuclides, the WAC 173-340 statistical guidance suggests that a test for distributional form be performed on the data and the 95% UCL calculated on the appropriate distribution using Ecology software. For nonradionuclide small data sets (n<10), the calculations are performed assuming nonparametric distribution, so no tests for distribution are performed. For nonradionuclide data sets of ten or greater, as for the subject site, distributional testing is done using Ecology's MTCAStat software (Ecology 1993). Due to differences in addressing censored data between the RDR/RAWP (DOE-RL 2009b) and MTCAStat coding and due to a limitation in the MTCAStat coding (no direct capability to address variable quantitation limits within a data set), substitutions for censored data are performed before software input and the resulting data set treated as uncensored.

The WAC 173-340-740(7)(e) 3-part test is performed for nonradionuclide analytes only and determines if:
1) the 95% UCL exceeds the most stringent cleanup limit for each COPC/COC,
2) greater than 10% of the raw data exceed the most stringent cleanup limit for each COPC/COC,
3) the maximum value of the raw data set exceeds two times the most stringent cleanup limit for each COPC/COC.

The RPD is calculated when both the primary value and the duplicate value for a given analyte are above detection limits and are greater than 5 times the target detection limit (TDL). The TDLs are pre-determined values for analytical methods and constituents with cleanup levels as listed in Table 2-1 of the SAP (DOE-RL 2009a). Table 2-1 includes nominal TDLs for identified methods based organic analyses. The nominal TDLs are also used in support of the RPD calculation for the methods based analytes. TDLs not included in Table 2-1 are based on the laboratory and/or methods used. Where direct evaluation of the attached sample data showed that a given analyte was not detected in the primary and/or duplicate sample, further evaluation of the RPD value was not performed. The RPD calculations use the following formula:

$$RPD = [\,|M-S|/((M+S)/2)]*100$$

where, M = Main Sample Value S = Split (or duplicate) Sample Value

For quality assurance/quality control (QA/QC) split and duplicate RPD calculations, a value less than 30% indicates the data compare favorably. If the RPD is greater than 30%, further investigation regarding the usability of the data is performed. To assist in the identification of anomalous sample pairs, when an analyte is detected in the primary or duplicate sample, but was quantified at less than 5 times the TDL in one or both samples, an additional parameter is evaluated. In this case, if the difference between the primary and duplicate results exceeds a control limit of 2 times the TDL, further assessment regarding the usability of the data is performed. Additional discussion as necessary is provided in the data quality assessment section of the applicable RSVP.

Summary (continued)

QUALIFIER LIST

B = estimate
J = estimate
N = recovery is outside control limits
P= >25% difference for detected concentrations between the two column analyses.
U = undetected
X = Serial dilution in the analytical batch indicates that physical and chemical interferences are present.
X (non-metal)= more than 40 % difference between colums, lower result reported.

ACRONYM LIST

-- = not applicable
DE = direct exposure
EXC = excavation
FS = focused sample
GW = groundwater
MDA = minimum detected activity
MTCA = *Model Toxics Control Act*
NA = not applicable
OB = overbuden
PQL = practical quantitation limit
Q = qualifier
QA/QC = quality assurance/quality control
RAG = remedial action goal
RDR/RAWP = remedial design report/remedial action work plan
RESRAD = RESidual RADioactivity (dose model)
RPD = relative percent difference
RSVP = remaining sites verification package
SAP = sampling and analysis plan
SPA = staging pile area
TDL = target detection limit
UCL = upper confidence limit
WAC = Washington Administrative Code

CALCULATION SHEET

Washington Closure Hanford

Originator	N. K. Schiffern	**Date**	10/09/12	**Calc. No.**	0100D-CA-V0477
Project	100-D Field Remediation	**Job No.**	14655	**Checked**	J. D. Skoglie
Subject	100-D-50:9 Subsite Service Area 2 Cleanup Verification 95% UCL Calculations				

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Results:
The results presented in the tables that follow include the summary of the results of the 95% UCL calculations for the excavation, overburden, staging pile area, focused sample, the WAC 173-340-740(7)(e) 3-part test evaluation, and the RPD calculations, and are for use in risk analysis and the RSVP for this subsite.

Results Summary [a]

Analyte	Excavation		Overburden		Staging Pile Area		Focused	Units
	95% UCL Result	Maximum Result	95% UCL Result	Maximum Result	95% UCL Result	Maximum Result		
Cesium-137	0.0215	--	0.0360	--	0.0260	--	--	pCi/g
Europium-155	--	--	0.0416	--	0.0473	--	--	pCi/g
Antimony	0.66	--	--	0.49	--	0.93	0.44	mg/kg
Arsenic	2.3	--	2.6	--	2.7	--	1.8	mg/kg
Barium	72.5	--	65.8	--	66.6	--	60.7	mg/kg
Beryllium	0.49	--	0.13	--	0.093	--	0.50	mg/kg
Boron	1.3	--	1.1	--	1.6	--	--	mg/kg
Cadmium	0.097	--	0.038	--	0.046	--	0.096	mg/kg
Chromium	11.2	--	10.4	--	10.0	--	8.2	mg/kg
Cobalt	8.1	--	8.2	--	8.8	--	8.5	mg/kg
Copper	15.7	--	16.5	--	17.3	--	15.8	mg/kg
Hexavalent Chromium	--	0.265	--	0.258	0.693	--	--	mg/kg
Lead	9.1	--	16.0	--	15.3	--	3.7	mg/kg
Manganese	330	--	319	--	333	--	319	mg/kg
Mercury	--	--	--	--	--	0.030	--	mg/kg
Molybdenum	--	0.32	--	0.29	0.30	--	--	mg/kg
Nickel	11.9	--	11.7	--	11.9	--	10.0	mg/kg
Vanadium	53.5	--	54.5	--	59.4	--	59.8	mg/kg
Zinc	40.2	--	43.4	--	68.2	--	40.9	mg/kg
Benzo(a)anthracene	--	15	--	5.9	--	14	--	ug/kg
Benzo(a)pyrene	--	24	--	--	--	7.0	--	ug/kg
Benzo(b)fluoranthene	--	66	--	15	--	11	--	ug/kg
Benzo(ghi)perylene	--	40	--	26	--	--	--	ug/kg
Benzo(k)fluoranthene	--	19	--	--	--	--	--	ug/kg
Chrysene	--	68	--	10	--	17	--	ug/kg
Fluoranthene	--	--	--	23	--	24	--	ug/kg
Indeno(1,2,3-cd)pyrene	--	39	--	13	--	--	--	ug/kg
Phenanthrene	--	--	--	--	--	26	--	ug/kg
Pyrene	--	--	--	20	--	30	--	ug/kg
Aroclor-1254	--	--	--	--	--	30	--	ug/kg
Aroclor-1260	--	--	--	--	--	27	--	ug/kg
4,4'-DDT	--	--	--	--	--	1.9	--	ug/kg

3-Part Test Evaluation

	Excavation		Overburden		Staging Pile Area	
95% UCL or Maximum > Cleanup Lim	NO	YES	YES	NO	YES	YES
> 10% above Cleanup Limit?	YES	NO	YES	NO	YES	NO
Any sample > 2x Cleanup Limit?	NO	YES	YES	NO	YES	NO

[a]The 95% UCL result or maximum value, depending on data censorship, as described in the methodology section.

Washington Closure Hanford **CALCULATION SHEET**

Originator	N. K. Schiffern	**Date**	10/09/12	**Calc. No.**	0100D-CA-V0477
Project	100-D Field Remediation	**Job No.**	14655	**Checked**	J. D. Skoglie
Subject	100-D-50:9 Subsite Service Area 2 Cleanup Verification 95% UCL Calculations				

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Date 10/09/12
Sheet No. 5 of 26

Summary (continued)

Results:
The results presented in the tables that follow include the summary of the results of the 95% UCL calculations for the excavation, overburden, staging pile area, focused sample, the WAC 173-340-740(7)(e) 3-part test evaluation, and the RPD calculations, and are for use in risk analysis and the RSVP for this site.

Relative Percent Difference Results and QA/QC Analysis[a]

Analyte	Duplicate Analysis		
	Excavation	**Overburden**	**Staging Pile Area**
Aluminum	1.6%	0.9%	10.0%
Barium	3.8%	3.9%	10.5%
Calcium	3.8%	0.6%	3.7%
Chromium	8.6%	2.6%	5.6%
Copper		2.5%	3.7%
Iron	6.4%	2.8%	0.4%
Magnesium	3.0%	3.9%	6.5%
Manganese	1.2%	0.3%	3.4%
Silicon	4.4%	3.8%	15.8%
Sodium			1.2%
Vanadium	7.3%	3.9%	3.8%
Zinc	3.2%	1.5%	2.1%

Grey cells indicate not applicable

[a] RPD listed where result produced, based on criteria. If RPD not required, no value is listed. The significance of the reported RPD values, including values greater than 30%, is addressed in the data quality assessment section of the RSVP.

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern NS	**Date** 10/09/12	**Calc. No.** 0100D-CA-V0477	**Rev. No.** 0
Project 100-D Field Remediation	**Job No.** 14655	**Checked** J. D. Skoglie JDS	**Date** 10/09/12
Subject 100-D-50:9 Subsite Service Area 2 Cleanup Verification 95% UCL Calculations			**Sheet No.** 6 of 26

100-D-50:9 Subsite Statistical Calculations

Verification Data -Excavation

Sample Area	Sample Number	Sample Date	Cesium-137 pCi/g	Q	MDA
EXC-1	J1R058	8/22/2012	0.0133	U	0.0288
Duplicate of J1R058	J1R070	8/22/2012	0.00625	U	0.0242
EXC-2	J1R059	8/22/2012	0.0251	U	0.0276
EXC-3	J1R060	8/22/2012	0.0707		0.0239
EXC-4	J1R061	8/22/2012	0.0303		0.0238
EXC-5	J1R062	8/22/2012	0.0115	U	0.0372
EXC-6	J1R063	8/22/2012	-0.00510	U	0.0255
EXC-7	J1R064	8/22/2012	0.00480	U	0.0358
EXC-8	J1R065	8/22/2012	-0.00427	U	0.0239
EXC-9	J1R066	8/22/2012	0.0115	U	0.0248
EXC-10	J1R067	8/22/2012	-0.0172	U	0.0353
EXC-11	J1R068	8/22/2012	-0.0120	U	0.0354
EXC-12	J1R069	8/22/2012	-0.00138	U	0.0249

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Cesium-137 pCi/g		
EXC-1	J1R058/J1R070	8/22/2012	0.00978		
EXC-2	J1R059	8/22/2012	0.0251		
EXC-3	J1R060	8/22/2012	0.0707		
EXC-4	J1R061	8/22/2012	0.0303		
EXC-5	J1R062	8/22/2012	0.0115		
EXC-6	J1R063	8/22/2012	-0.00510		
EXC-7	J1R064	8/22/2012	0.00480		
EXC-8	J1R065	8/22/2012	-0.00427		
EXC-9	J1R066	8/22/2012	0.0115		
EXC-10	J1R067	8/22/2012	-0.0172		
EXC-11	J1R068	8/22/2012	-0.0120		
EXC-12	J1R069	8/22/2012	-0.00138		

Statistical Computations

	Cesium-137		
95% UCL based on	Radionuclide data set. Use nonparametric z-statistic.		
N	12		
% < Detection limit	83%		
Mean	0.0103		
Standard deviation	0.0236		
Z-statistic	1.64		
95% UCL on mean	0.0215		
Maximum value	0.0707		

Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern NS	Date 10/09/12	Calc. No. 0100D-CA-V0477	Rev. No. 0
Project 100-D Field Remediation	Job No. 14655	Checked J. D. Skoglie	Date 10/09/12
Subject 100-D-50:9 Subsite Service Area 2 Cleanup Verification 95% UCL Calculations			Sheet No. 7 of 26

100-D-50:9 Subsite Statistical Calculations

Verification Data - Excavation

Sample Area	Sample Number	Sample Date	Antimony mg/kg	Q	PQL	Arsenic mg/kg	Q	PQL	Barium mg/kg	Q	PQL	Beryllium mg/kg	Q	PQL
EXC-1	J1R058	8/22/2012	0.52	BJ	0.36	2.6		0.62	75.5		0.071	0.51		0.031
Duplicate of J1R058	J1R070	8/22/2012	0.46	BJ	0.34	2.6		0.59	72.7		0.068	0.46		0.029
EXC-2	J1R059	8/22/2012	0.42	BJ	0.38	2.3		0.66	74.3		0.076	0.48		0.033
EXC-3	J1R060	8/22/2012	0.62	J	0.37	2.3		0.64	73.5		0.073	0.49		0.032
EXC-4	J1R061	8/22/2012	0.69	J	0.33	2.3		0.58	66.3		0.067	0.47		0.029
EXC-5	J1R062	8/22/2012	0.77	J	0.32	2.4		0.56	71.8		0.065	0.45		0.028
EXC-6	J1R063	8/22/2012	0.63	J	0.36	2.0		0.62	66.1		0.072	0.47		0.031
EXC-7	J1R064	8/22/2012	0.52	J	0.33	2.1		0.57	75.9		0.066	0.51		0.029
EXC-8	J1R065	8/22/2012	0.74	J	0.32	1.9		0.55	65.8		0.064	0.52		0.028
EXC-9	J1R066	8/22/2012	0.46	BJ	0.37	2.0		0.64	66.8		0.073	0.50		0.032
EXC-10	J1R067	8/22/2012	0.63	J	0.33	1.7		0.57	69.9		0.066	0.48		0.028
EXC-11	J1R068	8/22/2012	0.64	J	0.34	1.9		0.59	72.0		0.068	0.47		0.029
EXC-12	J1R069	8/22/2012	0.39	BJ	0.35	2.4		0.61	69.8		0.071	0.41		0.031

Sample Area	Sample Number	Sample Date	Boron mg/kg	Q	PQL	Cadmium mg/kg	Q	PQL	Chromium mg/kg	Q	PQL	Cobalt mg/kg	Q	PQL
EXC-1	J1R058	8/22/2012	1.3	B	0.92	0.11	B	0.039	11.1		0.055	7.8	X	0.094
Duplicate of J1R058	J1R070	8/22/2012	1.0	B	0.87	0.094	B	0.037	12.1		0.052	7.6	X	0.089
EXC-2	J1R059	8/22/2012	1.5	B	0.98	0.086	B	0.041	12.2		0.058	7.8	X	0.10
EXC-3	J1R060	8/22/2012	1.8	B	0.95	0.12	B	0.040	11.0		0.056	8.0	X	0.096
EXC-4	J1R061	8/22/2012	1.3	B	0.86	0.079	B	0.036	10.4		0.051	8.0	X	0.088
EXC-5	J1R062	8/22/2012	1.4	B	0.84	0.085	B	0.035	11.2		0.049	7.5	X	0.085
EXC-6	J1R063	8/22/2012	0.99	B	0.93	0.080	B	0.039	9.7		0.055	8.0	X	0.095
EXC-7	J1R064	8/22/2012	1.2	B	0.85	0.086	B	0.036	10.5		0.050	8.3	X	0.087
EXC-8	J1R065	8/22/2012	0.96	B	0.82	0.088	B	0.034	9.7		0.049	8.8	X	0.084
EXC-9	J1R066	8/22/2012	0.95	U	0.95	0.11	B	0.040	9.8		0.056	8.2	X	0.097
EXC-10	J1R067	8/22/2012	0.85	U	0.85	0.079	B	0.035	9.0		0.050	7.9	X	0.086
EXC-11	J1R068	8/22/2012	0.89	B	0.87	0.098	B	0.037	10.1		0.052	7.7	X	0.089
EXC-12	J1R069	8/22/2012	0.97	B	0.91	0.078	B	0.038	12.0		0.054	7.1	X	0.093

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Antimony mg/kg	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Boron mg/kg	Cadmium mg/kg	Chromium mg/kg	Cobalt mg/kg
EXC-1	J1R058/J1R070	8/22/2012	0.49	2.6	74.1	0.49	1.2	0.10	11.6	7.7
EXC-2	J1R059	8/22/2012	0.42	2.3	74.3	0.48	1.5	0.086	12.2	7.8
EXC-3	J1R060	8/22/2012	0.62	2.3	73.5	0.49	1.8	0.12	11.0	8.0
EXC-4	J1R061	8/22/2012	0.69	2.3	66.3	0.47	1.3	0.079	10.4	8.0
EXC-5	J1R062	8/22/2012	0.77	2.4	71.8	0.45	1.4	0.085	11.2	7.5
EXC-6	J1R063	8/22/2012	0.63	2.0	66.1	0.47	0.99	0.080	9.7	8.0
EXC-7	J1R064	8/22/2012	0.52	2.1	75.9	0.51	1.2	0.086	10.5	8.3
EXC-8	J1R065	8/22/2012	0.74	1.9	65.8	0.52	0.96	0.088	9.7	8.8
EXC-9	J1R066	8/22/2012	0.46	2.0	66.8	0.50	0.48	0.11	9.8	8.2
EXC-10	J1R067	8/22/2012	0.63	1.7	69.9	0.48	0.43	0.079	9.0	7.9
EXC-11	J1R068	8/22/2012	0.64	1.9	72.0	0.47	0.89	0.098	10.1	7.7
EXC-12	J1R069	8/22/2012	0.39	2.4	69.8	0.41	0.97	0.078	12.0	7.1

Statistical Computations

	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt
95% UCL based on	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat normal distribution.	Large data set (n ≥10), use MTCAStat normal distribution.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.
N	12	12	12	12	12	12	12	12
% < Detection limit	0%	0%	0%	0%	17%	0%	0%	0%
Mean	0.58	2.2	70.5	0.48	1.1	0.091	10.6	7.9
Standard deviation	0.12	0.26	3.6	0.029	0.40	0.014	1.0	0.42
95% UCL on mean	0.66	2.3	72.5	0.49	1.3	0.097	11.2	8.1
Maximum value	0.77	2.6	75.9	0.52	1.8	0.12	12.2	8.8
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)	5 GW & River Protection	20 DE, GW & River Protection	200 GW Protection	1.51 GW & River Protection	320 GW Protection	0.81 GW & River Protection	18.5 GW & River Protection	15.7 GW Protection
WAC 173-340 3-PART TEST								
95% UCL > Cleanup Limit?	NA	NA	NA	NA	NO	NA	NA	NA
> 10% above Cleanup Limit?	NA	NA	NA	NA	NO	NA	NA	NA
Any sample > 2X Cleanup Limit?	NA	NA	NA	NA	NO	NA	NA	NA
WAC 173-340 Compliance?	Because all values are below background (5 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (6.5 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (132 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (1.51 mg/kg) the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (0.81 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (18.5 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (15.7 mg/kg) the WAC 173-340 3-part test is not required.

Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern *NKS*	Date 10/09/12	Calc. No. 0100D-CA-V0477	Rev. No. 0
Project 100-D Field Remediation	Job No. 14655	Checked J. D. Skoglie *JDS*	Date 10/09/12
Subject 100-D-50:9 Subsite Service Area 2 Cleanup Verification 95% UCL Calculations			Sheet No. 8 of 26

100-D-50:9 Subsite Statistical Calculations

Verification Data - Excavation

Sample Area	Sample Number	Sample Date	Copper mg/kg	Copper Q	Copper PQL	Lead mg/kg	Lead Q	Lead PQL	Manganese mg/kg	Manganese Q	Manganese PQL	Nickel mg/kg	Nickel Q	Nickel PQL	Vanadium mg/kg	Vanadium Q	Vanadium PQL	Zinc mg/kg	Zinc Q	Zinc PQL
EXC-1	J1R058	8/22/2012	15.9		0.20	4.5		0.25	325		0.094	11.4		0.12	48.0		0.088	40.8	X	0.37
Duplicate of J1R058	J1R070	8/22/2012	15.9		0.19	4.4		0.24	321		0.089	12.6		0.11	44.6		0.084	39.5	X	0.35
EXC-2	J1R059	8/22/2012	16.5		0.22	5.2		0.27	321		0.10	11.9		0.12	48.9		0.094	40.5	X	0.40
EXC-3	J1R060	8/22/2012	16.4		0.21	15.6		0.26	314		0.096	11.4		0.12	54.7		0.091	42.2	X	0.38
EXC-4	J1R061	8/22/2012	16.1		0.19	18.3		0.24	331		0.088	10.7		0.11	52.1		0.083	39.7	X	0.35
EXC-5	J1R062	8/22/2012	15.5		0.19	9.2		0.23	289		0.085	13.9		0.10	48.4		0.080	36.4	X	0.34
EXC-6	J1R063	8/22/2012	15.0		0.21	4.3		0.26	336		0.095	11.0		0.12	53.8		0.089	37.9	X	0.38
EXC-7	J1R064	8/22/2012	14.8		0.19	4.2		0.23	346		0.087	10.8		0.11	52.0		0.081	40.2	X	0.34
EXC-8	J1R065	8/22/2012	15.4		0.18	3.7		0.23	324		0.084	12.3		0.10	57.9		0.079	40.9	X	0.33
EXC-9	J1R066	8/22/2012	15.0		0.21	4.0		0.26	325		0.097	10.4		0.12	56.2		0.091	39.5	X	0.38
EXC-10	J1R067	8/22/2012	14.1		0.19	3.6		0.23	320		0.086	9.7		0.11	51.3		0.081	39.2	X	0.34
EXC-11	J1R068	8/22/2012	14.0		0.19	3.6		0.24	330		0.089	10.7		0.11	50.1		0.084	38.4	X	0.35
EXC-12	J1R069	8/22/2012	14.7		0.20	3.7		0.25	304		0.093	11.0		0.11	45.9		0.087	36.7	X	0.37

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Copper mg/kg	Lead mg/kg	Manganese mg/kg	Nickel mg/kg	Vanadium mg/kg	Zinc mg/kg
EXC-1	J1R058/J1R070	8/22/2012	15.9	4.5	323	12.0	46.3	40.2
EXC-2	J1R059	8/22/2012	16.5	5.2	321	11.9	48.9	40.5
EXC-3	J1R060	8/22/2012	16.4	15.6	314	11.4	54.7	42.2
EXC-4	J1R061	8/22/2012	16.1	18.3	331	10.7	52.1	39.7
EXC-5	J1R062	8/22/2012	15.5	9.2	289	13.9	48.4	36.4
EXC-6	J1R063	8/22/2012	15.0	4.3	336	11.0	53.8	37.9
EXC-7	J1R064	8/22/2012	14.8	4.2	346	10.8	52.0	40.2
EXC-8	J1R065	8/22/2012	15.4	3.7	324	12.3	57.9	40.9
EXC-9	J1R066	8/22/2012	15.0	4.0	325	10.4	56.2	39.5
EXC-10	J1R067	8/22/2012	14.1	3.6	320	9.7	51.3	39.2
EXC-11	J1R068	8/22/2012	14.0	3.6	330	10.7	50.1	38.4
EXC-12	J1R069	8/22/2012	14.7	3.7	304	11.0	45.9	36.7

Statistical Computations

	Copper	Lead	Manganese	Nickel	Vanadium	Zinc
95% UCL based on	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.
N	12	12	12	12	12	12
% < Detection limit	0%	0%	0%	0%	0%	0%
Mean	15.3	6.7	322	11.3	51.5	39.3
Standard deviation	0.83	5.1	14.8	1.1	3.8	1.7
95% UCL on mean	15.7	9.1	330	11.9	53.5	40.2
Maximum value	16.5	18.3	346	13.9	57.9	42.2
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)	22.0 River Protection	10.2 GW & River Protection	512 GW & River Protection	19.1 GW Protection	85.1 GW Protection	67.8 River Protection
WAC 173-340 3-PART TEST						
95% UCL > Cleanup Limit?	NA	NO	NA	NA	NA	NA
> 10% above Cleanup Limit?	NA	YES	NA	NA	NA	NA
Any sample > 2X Cleanup Limit?	NA	NO	NA	NA	NA	NA
WAC 173-340 Compliance?	Because all values are below background (22.0 mg/kg) the WAC 173-340 3-part test is not required.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	Because all values are below background (512 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (19.1 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (85.1 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (67.8 mg/kg) the WAC 173-340 3-part test is not required.

Qualifiers are defined on page 3.

MAXIMUM VALUE 3-PART TEST CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern NS
Project 100-D Field Remediation
Subject 100-D-50:9 Subsite Service Area 2 Cleanup Verification 95% UCL Calculations

Date 10/09/12
Job No. 14655

Calc. No. 0100D-CA-V0477
Checked J. D. Skoglie JDS

Rev. No. 0
Date 10/09/12
Sheet No. 9 of 26

100-D-50:9 Subsite Maximum Calculations

Verification Data - Excavation

Sample Area	Sample Number	Sample Date	Hexavalent Chromium			Molybdenum			Benzo(a)anthracene			Benzo(a)pyrene		
			mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
EXC-1	J1R058	8/22/2012	0.155	U	0.155	0.24	U	0.24	3.2	U	3.2	6.4	U	6.4
Duplicate of J1R058	J1R070	8/22/2012	0.155	U	0.155	0.23	U	0.23	3.1	U	3.1	6.3	U	6.3
EXC-2	J1R059	8/22/2012	0.265		0.155	0.32	B	0.26	3.1	U	3.1	6.3	U	6.3
EXC-3	J1R060	8/22/2012	0.199		0.155	0.25	U	0.25	3.1	U	3.1	6.3	U	6.3
EXC-4	J1R061	8/22/2012	0.155	U	0.155	0.23	U	0.23	3.2	U	3.2	6.3	U	6.3
EXC-5	J1R062	8/22/2012	0.155	U	0.155	0.22	U	0.22	3.2	U	3.2	6.4	U	6.4
EXC-6	J1R063	8/22/2012	0.155	U	0.155	0.25	U	0.25	3.1	U	3.1	6.3	U	6.3
EXC-7	J1R064	8/22/2012	0.155	U	0.155	0.23	U	0.23	3.2	U	3.2	6.4	U	6.4
EXC-8	J1R065	8/22/2012	0.155	U	0.155	0.22	U	0.22	15		3.1	24		6.2
EXC-9	J1R066	8/22/2012	0.155	U	0.155	0.25	U	0.25	3.1	U	3.1	6.2	U	6.2
EXC-10	J1R067	8/22/2012	0.155	U	0.155	0.22	U	0.22	3.2	U	3.2	6.4	U	6.4
EXC-11	J1R068	8/22/2012	0.155	U	0.155	0.23	U	0.23	3.2	U	3.2	6.4	U	6.4
EXC-12	J1R069	8/22/2012	0.155	U	0.155	0.24	U	0.24	3.2	U	3.2	6.3	U	6.3

Sample Area	Benzo(b)fluoranthene			Benzo(ghi)perylene			Benzo(k)fluoranthene			Chrysene			Indeno(1,2,3-cd)pyrene		
	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
EXC-1	4.2	U	4.2	7.2	U	7.2	3.9	U	3.9	4.9	U	4.9	12	U	12
Duplicate of J1R058	4.1	U	4.1	7.1	U	7.1	3.9	U	3.9	4.8	U	4.8	12	U	12
EXC-2	4.1	U	4.1	7.1	U	7.1	3.9	U	3.9	4.8	U	4.8	12	U	12
EXC-3	4.1	U	4.1	7.1	U	7.1	3.9	U	3.9	4.8	U	4.8	12	U	12
EXC-4	4.1	U	4.1	7.1	U	7.1	3.9	U	3.9	4.8	U	4.8	12	U	12
EXC-5	4.2	U	4.2	7.2	U	7.2	3.9	U	3.9	4.8	U	4.8	12	U	12
EXC-6	4.1	U	4.1	7.1	U	7.1	3.9	U	3.9	4.8	U	4.8	12	U	12
EXC-7	4.2	U	4.2	7.2	U	7.2	3.9	U	3.9	4.8	U	4.8	12	U	12
EXC-8	66		4.1	40		7.0	19		3.8	68		4.7	39		12
EXC-9	4.1	U	4.1	7.0	U	7.0	3.8	U	3.8	4.7	U	4.7	12	U	12
EXC-10	4.2	U	4.2	7.2	U	7.2	3.9	U	3.9	4.8	U	4.8	12	U	12
EXC-11	4.2	U	4.2	7.2	U	7.2	3.9	U	3.9	4.8	U	4.8	12	U	12
EXC-12	4.2	U	4.2	7.1	U	7.1	3.9	U	3.9	4.8	U	4.8	12	U	12

Statistical Computations

	Hexavalent Chromium	Molybdenum	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene
% < Detection limit	83%	92%	92%	92%	92%
Maximum value	0.265	0.32	15	24	66
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless otherwise noted	2 River Protection	8 GW Protection	15 ug/kg GW and River Protection	15 ug/kg GW and River Protection	15 ug/kg GW and River Protection
WAC 173-340 3-PART TEST					
Maximum > Cleanup Limit?	NO	NO	NO	YES	YES
> 10% above Cleanup Limit?	NO	NO	NO	NO	NO
Any sample > 2X Cleanup Limit?	NO	NO	NO	NO	YES
3-Part Test Compliance?	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.

	Benzo(ghi)perylene	Benzo(k)fluoranthene	Chrysene	Indeno(1,2,3-cd)pyrene
% < Detection limit	92%	92%	92%	92%
Maximum value	40	19	68	39
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless otherwise noted	48000 ug/kg GW Protection	15 ug/kg GW and River Protection	100 ug/kg River Protection	330 ug/kg GW and River Protection
WAC 173-340 3-PART TEST				
Maximum > Cleanup Limit?	NO	YES	NO	NO
> 10% above Cleanup Limit?	NO	NO	NO	NO
Any sample > 2X Cleanup Limit?	NO	NO	NO	NO
3-Part Test Compliance?	The data set meets the 3-part test criteria when compared to the most stringent RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.

Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern NM

Project 100-D Field Remediation

Subject 100-D-50:9 Subsite Service Area 2 Cleanup Verification 95% UCL Calculations

Date 10/09/12

Job No. 14655

Calc. No. 0100D-CA-V0477

Checked J. D. Skoglie JDS

Rev. No. 0

Date 10/09/12

Sheet No. 10 of 26

100-D-50:9 Subsite Statistical Calculations

Verification Data -Overburden

Sample Area	Sample Number	Sample Date	Cesium-137 pCi/g	Q	MDA	Europium-155 pCi/g	Q	MDA
OB-12	J1R083	8/23/2012	0.0177	U	0.0248	0.0259	U	0.0669
Duplicate of J1R083	J1R084	8/23/2012	0.0454	U	0.0437	-0.0164	U	0.0897
OB-1	J1R072	8/23/2012	0.00458	U	0.0186	0.0597		0.0344
OB-2	J1R073	8/23/2012	0.0305	U	0.0258	0.0303	U	0.0439
OB-3	J1R074	8/23/2012	0.0472		0.0175	0.0409	U	0.0377
OB-4	J1R075	8/23/2012	0.0135	U	0.0266	0.00572	U	0.0785
OB-5	J1R076	8/23/2012	0.0315		0.0248	0.0339	U	0.0748
OB-6	J1R077	8/23/2012	-0.0161	U	0.0317	0.0280	U	0.0800
OB-7	J1R078	8/23/2012	-0.0119	U	0.0350	0.0129	U	0.0907
OB-8	J1R079	8/23/2012	0.00336	U	0.0354	0.0546	U	0.0880
OB-9	J1R080	8/23/2012	0.000972	U	0.0335	0.0486	U	0.0880
OB-10	J1R081	8/23/2012	0.00530	U	0.0248	0.0190	U	0.0549
OB-11	J1R082	8/23/2012	0.105		0.0204	0.0520	U	0.0441

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Cesium-137 pCi/g	Europium-155 pCi/g
OB-12	J1R083/J1R084	8/23/2012	0.0316	0.00475
OB-1	J1R072	8/23/2012	0.00458	0.0597
OB-2	J1R073	8/23/2012	0.0305	0.0303
OB-3	J1R074	8/23/2012	0.0472	0.0409
OB-4	J1R075	8/23/2012	0.0135	0.00572
OB-5	J1R076	8/23/2012	0.0315	0.0339
OB-6	J1R077	8/23/2012	-0.0161	0.0280
OB-7	J1R078	8/23/2012	-0.0119	0.0129
OB-8	J1R079	8/23/2012	0.00336	0.0546
OB-9	J1R080	8/23/2012	0.000972	0.0486
OB-10	J1R081	8/23/2012	0.00530	0.0190
OB-11	J1R082	8/23/2012	0.105	0.0520

Statistical Computations

	Cesium-137	Europium-155
95% UCL based on	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.
N	12	12
% < Detection limit	75%	92%
Mean	0.0205	0.0325
Standard deviation	0.0327	0.0191
Z-statistic	1.64	1.64
95% UCL on mean	0.0360	0.0416
Maximum value	0.105	0.0597

Qualifiers are defined on page 3.

Washington Closure Hanford

CALCULATION SHEET

Originator N. K. Schiffern NS **Date** 10/09/12 **Calc. No.** 0100D-CA-V0477 **Rev. No.** 0
Project 100-D Field Remediation **Job No.** 14655 **Checked** J. D. Skoglie **Date** 10/09/12
Subject 100-D-50:9 Subsite Service Area 2 Cleanup Verification 95% UCL Calculations **Sheet No.** 11 of 26

100-D-50:9 Subsite Statistical Calculations

Verification Data -Overburden

Sample Area	Sample Number	Sample Date	Arsenic mg/kg	Arsenic Q	Arsenic PQL	Barium mg/kg	Barium Q	Barium PQL	Beryllium mg/kg	Beryllium Q	Beryllium PQL	Boron mg/kg	Boron Q	Boron PQL
OB-12	J1R083	8/23/2012	2.7		0.64	68.0	X	0.074	0.17	B	0.032	1.3	B	0.96
Duplicate of J1R083	J1R084	8/23/2012	3.3		0.58	65.4	X	0.067	0.16	B	0.029	1.3	B	0.86
OB-1	J1R072	8/23/2012	2.5		0.57	62.4	X	0.066	0.086	B	0.029	1.1	B	0.85
OB-2	J1R073	8/23/2012	3.0		0.59	70.8	X	0.068	0.15	B	0.030	1.5	B	0.88
OB-3	J1R074	8/23/2012	2.6		0.58	62.4	X	0.066	0.10	B	0.029	1.1	B	0.86
OB-4	J1R075	8/23/2012	2.5		0.57	61.2	X	0.066	0.086	B	0.029	0.85	U	0.85
OB-5	J1R076	8/23/2012	2.4		0.63	64.5	X	0.073	0.12	B	0.032	1.4	B	0.94
OB-6	J1R077	8/23/2012	2.0		0.61	56.5	X	0.071	0.077	B	0.031	0.93	B	0.91
OB-7	J1R078	8/23/2012	2.6		0.59	68.4	X	0.068	0.12	B	0.030	0.99	B	0.88
OB-8	J1R079	8/23/2012	2.2		0.59	54.4	X	0.067	0.10	B	0.029	0.87	U	0.87
OB-9	J1R080	8/23/2012	2.4		0.66	68.1	X	0.076	0.087	B	0.033	0.98	U	0.98
OB-10	J1R081	8/23/2012	2.2		0.64	60.7	X	0.074	0.11	B	0.032	0.95	U	0.95
OB-11	J1R082	8/23/2012	2.4		0.57	61.6	X	0.066	0.12	B	0.029	0.85	U	0.85

Sample Area	Sample Number	Sample Date	Cadmium mg/kg	Cadmium Q	Cadmium PQL	Chromium mg/kg	Chromium Q	Chromium PQL	Cobalt mg/kg	Cobalt Q	Cobalt PQL	Copper mg/kg	Copper Q	Copper PQL
OB-12	J1R083	8/23/2012	0.058	B	0.040	11.2	X	0.057	7.8	X	0.098	16.4	X	0.21
Duplicate of J1R083	J1R084	8/23/2012	0.036	U	0.036	11.5	X	0.051	7.8	X	0.088	16.0	X	0.19
OB-1	J1R072	8/23/2012	0.036	B	0.036	9.9	X	0.050	8.5	X	0.087	17.2	X	0.19
OB-2	J1R073	8/23/2012	0.037	U	0.037	10.6	X	0.052	7.7	X	0.090	16.7	X	0.19
OB-3	J1R074	8/23/2012	0.036	U	0.036	9.9	X	0.051	8.0	X	0.087	16.3	X	0.19
OB-4	J1R075	8/23/2012	0.036	U	0.036	11.0	X	0.050	8.3	X	0.087	16.3	X	0.19
OB-5	J1R076	8/23/2012	0.039	U	0.039	9.3	X	0.055	7.3	X	0.096	15.8	X	0.21
OB-6	J1R077	8/23/2012	0.038	U	0.038	9.4	X	0.054	8.1	X	0.093	16.1	X	0.20
OB-7	J1R078	8/23/2012	0.056	B	0.037	9.5	X	0.052	7.7	X	0.090	15.4	X	0.19
OB-8	J1R079	8/23/2012	0.038	B	0.036	10.1	X	0.051	6.7	X	0.089	13.8	X	0.19
OB-9	J1R080	8/23/2012	0.046	B	0.041	9.4	X	0.058	8.6	X	0.10	16.8	X	0.22
OB-10	J1R081	8/23/2012	0.040	U	0.040	9.6	X	0.056	8.2	X	0.097	16.5	X	0.21
OB-11	J1R082	8/23/2012	0.046	B	0.036	10.1	X	0.050	7.5	X	0.087	15.8	X	0.19

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Boron mg/kg	Cadmium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg
OB-12	J1R083/J1R084	8/23/2012	3.0	66.7	0.17	1.3	0.038	11.4	7.8	16.2
OB-1	J1R072	8/23/2012	2.5	62.4	0.086	1.1	0.036	9.9	8.5	17.2
OB-2	J1R073	8/23/2012	3.0	70.8	0.15	1.5	0.019	10.6	7.7	16.7
OB-3	J1R074	8/23/2012	2.6	62.4	0.10	1.1	0.018	9.9	8.0	16.3
OB-4	J1R075	8/23/2012	2.5	61.2	0.086	0.43	0.018	11.0	8.3	16.3
OB-5	J1R076	8/23/2012	2.4	64.5	0.12	1.4	0.020	9.3	7.3	15.8
OB-6	J1R077	8/23/2012	2.0	56.5	0.077	0.93	0.019	9.4	8.1	16.1
OB-7	J1R078	8/23/2012	2.6	68.4	0.12	0.99	0.056	9.5	7.7	15.4
OB-8	J1R079	8/23/2012	2.2	54.4	0.10	0.44	0.038	10.1	6.7	13.8
OB-9	J1R080	8/23/2012	2.4	68.1	0.087	0.49	0.046	9.4	8.6	16.8
OB-10	J1R081	8/23/2012	2.2	60.7	0.11	0.48	0.020	9.6	8.2	16.5
OB-11	J1R082	8/23/2012	2.4	61.6	0.12	0.43	0.046	10.1	7.5	15.8

Statistical Computations

	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper
95% UCL based on	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.
N	12	12	12	12	12	12	12	12
% < Detection limit	0%	0%	0%	42%	50%	0%	0%	0%
Mean	2.5	63.1	0.11	0.88	0.031	10.0	7.9	16.1
Standard deviation	0.30	4.9	0.027	0.41	0.014	0.66	0.54	0.87
95% UCL on mean	2.6	65.8	0.13	1.1	0.038	10.4	8.2	16.5
Maximum value	3.3	70.8	0.17	1.5	0.058	11.5	8.6	17.2
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)	20 DE, GW & River Protection	200 GW Protection	1.51 GW & River Protection	320 GW Protection	0.81 GW & River Protection	18.5 GW & River Protection	15.7 GW Protection	22.0 River Protection
WAC 173-340 3-PART TEST								
95% UCL > Cleanup Limit?	NA	NA	NA	NO	NA	NA	NA	NA
> 10% above Cleanup Limit?	NA	NA	NA	NO	NA	NA	NA	NA
Any sample > 2X Cleanup Limit?	NA	NA	NA	NO	NA	NA	NA	NA
WAC 173-340 Compliance?	Because all values are below background (6.5 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (132 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (1.51 mg/kg) the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (0.81 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (18.5 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (15.7 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (22.0 mg/kg) the WAC 173-340 3-part test is not required.

Qualifiers are defined on page 3.

Washington Closure Hanford

CALCULATION SHEET

Originator N. K. Schiffern NS
Project 100-D Field Remediation
Subject 100-D-50:9 Subsite Service Area 2 Cleanup Verification 95% UCL Calculations

Date 10/09/12
Job No. 14655

Calc. No. 0100D-CA-V0477
Checked J. D. Skoglie

Rev. No. 0
Date 10/09/12
Sheet No. 12 of 26

1 **100-D-50:9 Subsite Statistical Calculations**

2 **Verification Data - Overburden**

	Sample Area	Sample Number	Sample Date	Lead			Manganese			Nickel			Vanadium			Zinc		
3/4				mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
5	OB-12	J1R083	8/23/2012	6.0		0.26	323	X	0.098	11.7	X	0.12	49.3	X	0.092	41.3	X	0.39
6	Duplicate of J1R083	J1R084	8/23/2012	5.8		0.24	324	X	0.088	12.9	X	0.11	47.4	X	0.082	40.7	X	0.35
7	OB-1	J1R072	8/23/2012	6.4		0.23	314	X	0.087	12.5	X	0.11	55.2	X	0.081	42.7	X	0.35
8	OB-2	J1R073	8/23/2012	7.0		0.24	329	X	0.090	11.4	X	0.11	49.3	X	0.084	41.3	X	0.36
9	OB-3	J1R074	8/23/2012	7.7		0.24	309	X	0.087	10.6	X	0.11	54.4	X	0.082	45.2	X	0.35
10	OB-4	J1R075	8/23/2012	4.4		0.23	321	X	0.087	12.7	X	0.11	54.1	X	0.082	41.0	X	0.35
11	OB-5	J1R076	8/23/2012	5.4		0.26	303	X	0.096	9.9	X	0.12	48.4	X	0.090	43.3	X	0.38
12	OB-6	J1R077	8/23/2012	47.6		0.25	321	X	0.093	9.9	X	0.11	56.3	X	0.088	44.2	X	0.37
13	OB-7	J1R078	8/23/2012	5.9		0.24	310	X	0.090	11.1	X	0.11	52.7	X	0.084	42.2	X	0.36
14	OB-8	J1R079	8/23/2012	4.2		0.24	280	X	0.089	10.5	X	0.11	43.5	X	0.083	37.4	X	0.35
15	OB-9	J1R080	8/23/2012	16.2		0.27	324	X	0.10	11.2	X	0.12	58.4	X	0.094	44.8	X	0.40
16	OB-10	J1R081	8/23/2012	7.6		0.26	319	X	0.097	11.3	X	0.12	54.3	X	0.091	43.1	X	0.38
17	OB-11	J1R082	8/23/2012	3.9		0.23	299	X	0.087	11.3	X	0.11	50.2	X	0.082	39.2	X	0.35

18 **Statistical Computation Input Data**

	Sample Area	Sample Number	Sample Date	Lead mg/kg	Manganese mg/kg	Nickel mg/kg	Vanadium mg/kg	Zinc mg/kg
21	OB-12	J1R083/J1R084	8/23/2012	5.9	324	12.3	48.4	41.0
22	OB-1	J1R072	8/23/2012	6.4	314	12.5	55.2	42.7
23	OB-2	J1R073	8/23/2012	7.0	329	11.4	49.3	41.3
24	OB-3	J1R074	8/23/2012	7.7	309	10.6	54.4	45.2
25	OB-4	J1R075	8/23/2012	4.4	321	12.7	54.1	41.0
26	OB-5	J1R076	8/23/2012	5.4	303	9.9	48.4	43.3
27	OB-6	J1R077	8/23/2012	47.6	321	9.9	56.3	44.2
28	OB-7	J1R078	8/23/2012	5.9	310	11.1	52.7	42.2
29	OB-8	J1R079	8/23/2012	4.2	280	10.5	43.5	37.4
30	OB-9	J1R080	8/23/2012	16.2	324	11.2	58.4	44.8
31	OB-10	J1R081	8/23/2012	7.6	319	11.3	54.3	43.1
32	OB-11	J1R082	8/23/2012	3.9	299	11.3	50.2	39.2

33 **Statistical Computations**

		Lead	Manganese	Nickel	Vanadium	Zinc
35	95% UCL based on	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.
36	N	12	12	12	12	12
37	% < Detection limit	0%	0%	0%	0%	0%
38	Mean	10.2	313	11.2	52.1	42.1
39	Standard deviation	12.2	13.7	0.93	4.2	2.3
40	95% UCL on mean	16.0	319	11.7	54.5	43.4
41	Maximum value	47.6	329	12.9	58.4	45.2
42	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)**	10.2 GW & River Protection	512 GW & River Protection	19.1 GW Protection	85.1 GW Protection	67.8 River Protection
43	**WAC 173-340 3-PART TEST**					
44	95% UCL > Cleanup Limit?	YES	NA	NA	NA	NA
45	> 10% above Cleanup Limit?	YES	NA	NA	NA	NA
46	Any sample > 2X Cleanup Limit?	YES	NA	NA	NA	NA
47	**WAC 173-340 Compliance?**	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	Because all values are below background (512 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (19.1 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (85.1 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (67.8 mg/kg) the WAC 173-340 3-part test is not required.

48 Qualifiers are defined on page 3.

MAXIMUM VALUE 3-PART TEST CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern NS
Project 100-D Field Remediation
Subject 100-D-50:9 Subsite Service Area 2 Cleanup Verification 95% UCL Calculations

Date 10/09/12
Job No. 14655

Calc. No. 0100D-CA-V0477
Checked J. D. Skoglie JD

Rev. No. 0
Date 10/09/12
Sheet No. 13 of 26

100-D-50:9 Subsite Maximum Calculations

Verification Data - Overburden

Sample Area	Sample Number	Sample Date	Antimony			Hexavalent Chromium			Molybdenum		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
OB-12	J1R083	8/23/2012	0.37	U	0.37	0.155	U	0.155	0.25	U	0.25
Duplicate of J1R083	J1R084	8/23/2012	0.33	U	0.33	0.155	U	0.155	0.23	U	0.23
OB-1	J1R072	8/23/2012	0.33	U	0.33	0.155	U	0.155	0.29	B	0.23
OB-2	J1R073	8/23/2012	0.34	U	0.34	0.155	U	0.155	0.29	B	0.23
OB-3	J1R074	8/23/2012	0.33	U	0.33	0.155	U	0.155	0.23	U	0.23
OB-4	J1R075	8/23/2012	0.33	U	0.33	0.155	U	0.155	0.23	U	0.23
OB-5	J1R076	8/23/2012	0.36	U	0.36	0.214		0.155	0.25	U	0.25
OB-6	J1R077	8/23/2012	0.49	B	0.35	0.214		0.155	0.24	U	0.24
OB-7	J1R078	8/23/2012	0.34	B	0.34	0.258		0.155	0.23	U	0.23
OB-8	J1R079	8/23/2012	0.34	U	0.34	0.155	U	0.155	0.23	U	0.23
OB-9	J1R080	8/23/2012	0.38	U	0.38	0.192		0.155	0.26	U	0.26
OB-10	J1R081	8/23/2012	0.37	U	0.37	0.155	U	0.155	0.25	U	0.25
OB-11	J1R082	8/23/2012	0.33	U	0.33	0.155	U	0.155	0.23	U	0.23

Sample Area	Benzo(a)anthracene			Benzo(b)fluoranthene			Benzo(ghi)perylene			Chrysene		
	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
OB-12	3.1	U	3.1	4.0	U	4.0	6.9	U	6.9	4.6	U	4.6
Duplicate of J1R083	3.1	U	3.1	4.2	JX	4.1	7.1	U	7.1	4.8	U	4.8
OB-1	5.9	JX	3.2	12	J	4.2	7.4	JX	7.1	10	J	4.8
OB-2	3.1	U	3.1	4.1	U	4.1	7.1	U	7.1	4.8	U	4.8
OB-3	3.0	U	3.0	15		4.0	26	J	6.8	4.6	U	4.6
OB-4	3.1	U	3.1	4.1	U	4.1	7.1	U	7.1	4.8	U	4.8
OB-5	3.1	U	6.2	4.1	U	4.1	6.9	U	6.9	4.7	U	4.7
OB-6	3.1	U	3.1	4.1	U	4.1	7.1	U	7.1	4.8	U	4.8
OB-7	3.0	U	3.0	4.0	U	4.0	6.8	U	6.8	4.6	U	4.6
OB-8	3.0	U	3.0	4.8	J	3.9	6.7	U	6.7	4.5	U	4.5
OB-9	3.1	U	3.1	4.1	U	4.1	7.0	U	7.0	4.7	U	4.7
OB-10	3.1	U	3.1	4.1	U	4.1	7.0	U	7.0	4.7	U	4.7
OB-11	3.1	U	3.1	4.1	U	4.1	7.1	U	7.1	4.7	U	4.7

Statistical Computations

	Antimony	Hexavalent Chromium	Molybdenum	Benzo(a)anthracene	Benzo(b)fluoranthene	Benzo(ghi)perylene	Chrysene
% < Detection limit	83%	67%	83%	92%	67%	83%	92%
Maximum value	0.49	0.258	0.29	5.9	15	26	10
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless otherwise noted	5 GW & River Protection	2 River Protection	8 GW Protection	15 ug/kg GW and River Protection	15 ug/kg GW and River Protection	48000 ug/kg GW Protection	100 ug/kg River Protection
WAC 173-340 3-PART TEST							
Maximum > Cleanup Limit?	NA	NO	NO	NO	NO	NO	NO
> 10% above Cleanup Limit?	NA	NO	NO	NO	NO	NO	NO
Any sample > 2X Cleanup Limit?	NA	NO	NO	NO	NO	NO	NO
3-Part Test Compliance?	Because all values are below background (5 mg/kg) the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.

Verification Data - Overburden

Sample Area	Sample Number	Sample Date	Fluoranthene			Indeno(1,2,3-cd)pyrene			Pyrene		
			ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
OB-12	J1R083	8/23/2012	12	U	12	11	U	11	11	U	11
Duplicate of J1R083	J1R084	8/23/2012	13	U	13	12	U	12	12	U	12
OB-1	J1R072	8/23/2012	23	J	13	12	U	12	20	J	12
OB-2	J1R073	8/23/2012	13	U	13	12	U	12	12	U	12
OB-3	J1R074	8/23/2012	12	U	12	13	JX	11	11	U	11
OB-4	J1R075	8/23/2012	13	U	13	12	U	12	12	U	12
OB-5	J1R076	8/23/2012	13	U	13	12	U	12	12	U	12
OB-6	J1R077	8/23/2012	13	U	13	12	U	12	12	U	12
OB-7	J1R078	8/23/2012	12	U	12	11	U	11	11	U	11
OB-8	J1R079	8/23/2012	12	U	12	11	U	11	11	U	11
OB-9	J1R080	8/23/2012	13	U	13	12	U	12	12	U	12
OB-10	J1R081	8/23/2012	13	U	13	12	U	12	12	U	12
OB-11	J1R082	8/23/2012	13	U	13	12	U	12	12	U	12

Statistical Computations

	Fluoranthene	Indeno(1,2,3-cd)pyrene	Pyrene
% < Detection limit	92%	92%	92%
Maximum value	23	13	20
Most Stringent Cleanup Limit for nonradionuclide and RAG type (ug/kg)	18000 River Protection	330 GW and River Protection	48000 GW Protection
WAC 173-340 3-PART TEST			
Maximum > Cleanup Limit?	NO	NO	NO
> 10% above Cleanup Limit?	NO	NO	NO
Any sample > 2X Cleanup Limit?	NO	NO	NO
3-Part Test Compliance?	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.

Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern NS	**Date** 10/09/12	**Calc. No.** 0100D-CA-V0477	**Rev. No.** 0
Project 100-D Field Remediation	**Job No.** 14655	**Checked** J. D. Skoglie JDS	**Date** 10/09/12
Subject 100-D-50:9 Subsite Service Area 2 Cleanup Verification 95% UCL Calculations			**Sheet No.** 14 of 26

100-D-50:9 Subsite Statistical Calculations

Verification Data -Staging pile Area

Sample Area	Sample Number	Sample Date	Cesium-137 pCi/g	Q	MDA	Europium-155 pCi/g	Q	MDA
SPA-2	J1R087	8/23/2012	0.00761	U	0.0295	0.0590	U	0.0647
Duplicate of J1R087	J1R098	8/23/2012	0.0122	U	0.0273	0.0389	U	0.0720
SPA-1	J1R086	8/23/2012	0.0156	U	0.0252	0.0274	U	0.0406
SPA-3	J1R088	8/23/2012	0.0139	U	0.0262	0.0299	U	0.0661
SPA-4	J1R089	8/23/2012	0.0257		0.0200	0.0535	U	0.0467
SPA-5	J1R090	8/23/2012	0.0587		0.0269	0.0540	U	0.0502
SPA-6	J1R091	8/23/2012	0.0153	U	0.0280	0.0533	U	0.0799
SPA-7	J1R092	8/23/2012	0.0245	U	0.0239	0.0390		0.0376
SPA-8	J1R093	8/23/2012	0.0294	U	0.0278	0.0217	U	0.0419
SPA-9	J1R094	8/23/2012	0.0186	U	0.0280	0.0202	U	0.0575
SPA-10	J1R095	8/23/2012	0.00508	U	0.0232	0.0115	U	0.0621
SPA-11	J1R096	8/23/2012	0.0102	U	0.0244	0.0568	U	0.0487
SPA-12	J1R097	8/23/2012	-0.00346	U	0.0263	0.0571	U	0.0858

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Cesium-137 pCi/g	Europium-155 pCi/g
SPA-2	J1R087/J1R098	8/23/2012	0.00991	0.0490
SPA-1	J1R086	8/23/2012	0.0156	0.0274
SPA-3	J1R088	8/23/2012	0.0139	0.0299
SPA-4	J1R089	8/23/2012	0.0257	0.0535
SPA-5	J1R090	8/23/2012	0.0587	0.0540
SPA-6	J1R091	8/23/2012	0.0153	0.0533
SPA-7	J1R092	8/23/2012	0.0245	0.0390
SPA-8	J1R093	8/23/2012	0.0294	0.0217
SPA-9	J1R094	8/23/2012	0.0186	0.0202
SPA-10	J1R095	8/23/2012	0.00508	0.0115
SPA-11	J1R096	8/23/2012	0.0102	0.0568
SPA-12	J1R097	8/23/2012	-0.00346	0.0571

Statistical Computations

	Cesium-137	Europium-155
95% UCL based on	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.
N	12	12
% < Detection limit	83%	92%
Mean	0.0186	0.0394
Standard deviation	0.0156	0.0165
Z-statistic	1.64	1.64
95% UCL on mean	0.0260	0.0473
Maximum value	0.0587	0.0390

Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern NS
Project 100-D Field Remediation
Subject 100-D-50:9 Subsite Service Area 2 Cleanup Verification 95% UCL Calculations
Date 10/09/12
Job No. 14655
Calc. No. 0100D-CA-V0477
Checked J. D. Skoglie JDS
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1 **100-D-50:9 Subsite Statistical Calculations**

2 **Verification Data - Staging Pile Area**

	Sample Area	Sample Number	Sample Date	Arsenic mg/kg	Arsenic Q	Arsenic PQL	Barium mg/kg	Barium Q	Barium PQL	Beryllium mg/kg	Beryllium Q	Beryllium PQL	Boron mg/kg	Boron Q	Boron PQL
5	SPA-2	J1R087	8/23/2012	2.6		0.62	73.5		0.071	0.072	B	0.031	1.2	B	0.92
6	Duplicate of J1R087	J1R098	8/23/2012	2.3		0.62	66.2		0.071	0.048	B	0.031	0.91	U	0.91
7	SPA-1	J1R086	8/23/2012	2.5		0.61	58.2		0.071	0.056	B	0.031	0.96	B	0.91
8	SPA-3	J1R088	8/23/2012	1.9		0.66	56.5		0.076	0.033	U	0.033	0.98	U	0.98
9	SPA-4	J1R089	8/23/2012	2.6		0.61	78.1		0.070	0.12	B	0.031	1.0	B	0.91
10	SPA-5	J1R090	8/23/2012	2.8		0.59	60.7		0.068	0.11	B	0.029	0.92	B	0.87
11	SPA-6	J1R091	8/23/2012	1.5		0.63	52.2		0.073	0.032	U	0.032	0.94	U	0.94
12	SPA-7	J1R092	8/23/2012	3.0		0.56	53.6		0.064	0.075	B	0.028	0.83	U	0.83
13	SPA-8	J1R093	8/23/2012	3.1		0.64	68.1		0.074	0.15	B	0.032	1.2	B	0.96
14	SPA-9	J1R094	8/23/2012	2.2		0.61	60.4		0.071	0.080	B	0.031	2.0		0.91
15	SPA-10	J1R095	8/23/2012	1.7		0.59	58.3		0.068	0.029	U	0.029	0.87	U	0.87
16	SPA-11	J1R096	8/23/2012	2.6		0.56	73.1		0.064	0.098	B	0.028	2.9		0.83
17	SPA-12	J1R097	8/23/2012	1.8		0.65	55.7		0.075	0.050	B	0.033	0.97	U	0.97

	Sample Area	Sample Number	Cadmium mg/kg	Cadmium Q	Cadmium PQL	Chromium mg/kg	Chromium Q	Chromium PQL	Cobalt mg/kg	Cobalt Q	Cobalt PQL	Copper mg/kg	Copper Q	Copper PQL
5	SPA-2	J1R087	0.039	U	0.039	9.2		0.055	8.6	X	0.094	16.5		0.20
6	Duplicate of J1R087	J1R098	0.051	B	0.038	8.7		0.054	8.6	X	0.093	15.9		0.20
7	SPA-1	J1R086	0.038	U	0.038	7.9		0.054	8.5	X	0.093	17.0		0.20
8	SPA-3	J1R088	0.041	U	0.041	8.4		0.058	9.8	X	0.10	15.9		0.22
9	SPA-4	J1R089	0.054	B	0.038	9.3		0.054	9.5	X	0.092	18.1		0.20
10	SPA-5	J1R090	0.036	U	0.036	11.5		0.052	8.0	X	0.089	17.9		0.19
11	SPA-6	J1R091	0.039	U	0.039	7.2		0.056	9.1	X	0.096	15.8		0.21
12	SPA-7	J1R092	0.062	B	0.035	9.7		0.049	8.5	X	0.085	17.2		0.18
13	SPA-8	J1R093	0.040	U	0.040	11.2		0.057	7.6	X	0.098	18.1		0.21
14	SPA-9	J1R094	0.058	B	0.038	10.1		0.054	7.1	X	0.093	15.7		0.20
15	SPA-10	J1R095	0.051	B	0.036	8.4		0.052	8.3	X	0.089	16.3		0.19
16	SPA-11	J1R096	0.067	B	0.035	9.6		0.049	7.8	X	0.084	16.9		0.18
17	SPA-12	J1R097	0.040	U	0.040	9.6		0.057	8.0	X	0.099	16.3		0.21

18 **Statistical Computation Input Data**

	Sample Area	Sample Number	Sample Date	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Boron mg/kg	Cadmium mg/kg	Chromium mg/kg	Cobalt mg/kg	Copper mg/kg
21	SPA-2	J1R087/J1R098	8/23/2012	2.5	69.9	0.060	0.83	0.035	9.0	8.6	16.2
22	SPA-1	J1R086	8/23/2012	2.5	58.2	0.056	0.96	0.019	7.9	8.5	17.0
23	SPA-3	J1R088	8/23/2012	1.9	56.5	0.017	0.49	0.021	8.4	9.8	15.9
24	SPA-4	J1R089	8/23/2012	2.6	78.1	0.12	1.0	0.054	9.3	9.5	18.1
25	SPA-5	J1R090	8/23/2012	2.8	60.7	0.11	0.92	0.018	11.5	8.0	17.9
26	SPA-6	J1R091	8/23/2012	1.5	52.2	0.016	0.47	0.020	7.2	9.1	15.8
27	SPA-7	J1R092	8/23/2012	3.0	53.6	0.075	0.42	0.062	9.7	8.5	17.2
28	SPA-8	J1R093	8/23/2012	3.1	68.1	0.15	1.2	0.020	11.2	7.6	18.1
29	SPA-9	J1R094	8/23/2012	2.2	60.4	0.080	2.0	0.058	10.1	7.1	15.7
30	SPA-10	J1R095	8/23/2012	1.7	58.3	0.015	0.44	0.051	8.4	8.3	16.3
31	SPA-11	J1R096	8/23/2012	2.6	73.1	0.098	2.9	0.067	9.6	7.8	16.9
32	SPA-12	J1R097	8/23/2012	1.8	55.7	0.050	0.49	0.020	9.6	8.0	16.3

33 **Statistical Computations**

		Arsenic	Barium	Beryllium	Boron
35	95% UCL based on	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat normal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.
36	N	12	12	12	12
37	% < Detection limit	0%	0%	25%	42%
38	Mean	2.3	62.1	0.071	1.0
39	Standard deviation	0.52	8.3	0.044	0.75
40	95% UCL on mean	2.7	66.6	0.093	1.6
41	Maximum value	3.1	78.1	0.15	2.9
42	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)**	20 DE, GW & River Protection	200 GW Protection	1.51 GW & River Protection	320 GW Protection
43	**WAC 173-340 3-PART TEST**				
44	95% UCL > Cleanup Limit?	NA	NA	NA	NO
45	> 10% above Cleanup Limit?	NA	NA	NA	NO
46	Any sample > 2X Cleanup Limit?	NA	NA	NA	NO
47	**WAC 173-340 Compliance?**	Because all values are below background (6.5 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (132 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (1.51 mg/kg) the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent RAG.

		Cadmium	Chromium	Cobalt	Copper
35	95% UCL based on	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.
36	N	12	12	12	12
37	% < Detection limit	50%	0%	0%	0%
38	Mean	0.037	9.3	8.4	16.8
39	Standard deviation	0.020	1.3	0.78	0.89
40	95% UCL on mean	0.046	10.0	8.8	17.3
41	Maximum value	0.067	11.5	9.8	18.1
42	**Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)**	0.81 GW & River Protection	18.5 GW & River Protection	15.7 GW Protection	22.0 River Protection
43	**WAC 173-340 3-PART TEST**				
44	95% UCL > Cleanup Limit?	NA	NA	NA	NA
45	> 10% above Cleanup Limit?	NA	NA	NA	NA
46	Any sample > 2X Cleanup Limit?	NA	NA	NA	NA
47	**WAC 173-340 Compliance?**	Because all values are below background (0.81 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (18.5 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (15.7 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (22.0 mg/kg) the WAC 173-340 3-part test is not required.

48 Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern NS
Project 100-D Field Remediation
Subject 100-D-50:9 Subsite Service Area 2 Cleanup Verification 95% UCL Calculations

Date 10/09/12
Job No. 14655

Calc. No. 0100D-CA-V0477
Checked J. D. Skoglie JDS

Rev. No. 0
Date 10/09/12
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100-D-50:9 Subsite Statistical Calculations

Verification Data - Staging Pile Area

Sample Area	Sample Number	Sample Date	Hexavalent Chromium mg/kg	Q	PQL	Lead mg/kg	Q	PQL	Manganese mg/kg	Q	PQL	Molybdenum mg/kg	Q	PQL	Nickel mg/kg	Q	PQL	Vanadium mg/kg	Q	PQL	Zinc mg/kg	Q	PQL
SPA-2	J1R087	8/23/2012	0.265		0.155	9.3		0.25	328		0.094	0.31	B	0.24	10.4	X	0.12	61.7		0.088	46.1		0.37
Duplicate of J1R087	J1R098	8/23/2012	1.04		0.155	7.9		0.25	317		0.093	0.24	U	0.24	9.2	X	0.11	64.1		0.088	47.1		0.37
SPA-1	J1R086	8/23/2012	0.238		0.155	3.6		0.25	321		0.093	0.33	B	0.24	9.3	X	0.11	60.3		0.088	42.3		0.37
SPA-3	J1R088	8/23/2012	0.244		0.155	27.7		0.27	309		0.10	0.26	U	0.26	11.0	X	0.12	58.6		0.094	47.5		0.40
SPA-4	J1R089	8/23/2012	0.307		0.155	11.0		0.25	413		0.092	0.28	B	0.24	12.0	X	0.11	56.9		0.087	45.1		0.37
SPA-5	J1R090	8/23/2012	0.155	U	0.155	7.6		0.24	311		0.089	0.23	U	0.23	13.5	X	0.11	53.2		0.084	41.8		0.35
SPA-6	J1R091	8/23/2012	0.155	U	0.155	6.5		0.26	315		0.096	0.25	U	0.25	10.7	X	0.12	63.4		0.090	42.3		0.38
SPA-7	J1R092	8/23/2012	0.155	U	0.155	4.4		0.23	317		0.085	0.22	B	0.22	11.6	X	0.10	55.7		0.080	40.6		0.34
SPA-8	J1R093	8/23/2012	0.158		0.155	9.2		0.26	304		0.098	0.25	U	0.25	12.5	X	0.12	47.2		0.092	38.8		0.39
SPA-9	J1R094	8/23/2012	0.199		0.155	6.2		0.25	294		0.093	0.42	B	0.24	10.1	X	0.11	48.9		0.087	40.9		0.37
SPA-10	J1R095	8/23/2012	1.41		0.155	7.1		0.24	307		0.089	0.31	B	0.23	10.5	X	0.11	59.2		0.084	154		0.35
SPA-11	J1R096	8/23/2012	0.350		0.155	23.8		0.23	312		0.084	0.24	B	0.22	10.5	X	0.10	55.4		0.079	47.6		0.34
SPA-12	J1R097	8/23/2012	0.155	U	0.155	5.3		0.27	292		0.099	0.26	U	0.26	12.4	X	0.12	57.6		0.093	48.2		0.39

Statistical Computation Input Data

Sample Area	Sample Number	Sample Date	Hexavalent Chromium mg/kg	Lead mg/kg	Manganese mg/kg	Molybdenum mg/kg	Nickel mg/kg	Vanadium mg/kg	Zinc mg/kg
SPA-2	J1R087/J1R098	8/23/2012	0.653	8.6	323	0.22	9.8	62.9	46.6
SPA-1	J1R086	8/23/2012	0.238	3.6	321	0.33	9.3	60.3	42.3
SPA-3	J1R088	8/23/2012	0.244	27.7	309	0.13	11.0	58.6	47.5
SPA-4	J1R089	8/23/2012	0.307	11.0	413	0.28	12.0	56.9	45.1
SPA-5	J1R090	8/23/2012	0.0775	7.6	311	0.12	13.5	53.2	41.8
SPA-6	J1R091	8/23/2012	0.0775	6.5	315	0.13	10.7	63.4	42.3
SPA-7	J1R092	8/23/2012	0.0775	4.4	317	0.22	11.6	55.7	40.6
SPA-8	J1R093	8/23/2012	0.158	9.2	304	0.13	12.5	47.2	38.8
SPA-9	J1R094	8/23/2012	0.199	6.2	294	0.42	10.1	48.9	40.9
SPA-10	J1R095	8/23/2012	1.41	7.1	307	0.31	10.5	59.2	154
SPA-11	J1R096	8/23/2012	0.350	23.8	312	0.24	10.5	55.4	47.6
SPA-12	J1R097	8/23/2012	0.0775	5.3	292	0.13	12.4	57.6	48.2

Statistical Computations

	Hexavalent Chromium	Lead	Manganese	Molybdenum	Nickel	Vanadium	Zinc
95% UCL based on	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), use MTCAStat lognormal distribution.	Large data set (n ≥10), lognormal and normal distribution rejected, use z-statistic.
N	12	12	12	12	12	12	12
% < Detection limit	33%	0%	0%	42%	0%	0%	0%
Mean	0.322	10.1	318	0.22	11.2	56.6	53.0
Standard deviation	0.380	7.6	31.3	0.10	1.3	5.0	32.0
95% UCL on mean	0.693	15.3	333	0.30	11.9	59.4	68.2
Maximum value	1.41	27.7	413	0.42	13.5	64.1	154
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg)	2.0 River Protection	10.2 GW & River Protection	512 GW & River Protection	8 GW Protection	19.1 GW Protection	85.1 GW Protection	67.8 River Protection
WAC 173-340 3-PART TEST							
95% UCL > Cleanup Limit?	NO	YES	NA	NO	NA	NA	YES
> 10% above Cleanup Limit?	NO	YES	NA	NO	NA	NA	NO
Any sample > 2X Cleanup Limit?	NO	YES	NA	NO	NA	NA	YES
WAC 173-340 Compliance?	The data set meets the 3-part test criteria when compared to the most stringent RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	Because all values are below background (512 mg/kg) the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	Because all values are below background (19.1 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (85.1 mg/kg) the WAC 173-340 3-part test is not required.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.

Qualifiers are defined on page 3.

Washington Closure Hanford

MAXIMUM VALUE 3-PART TEST CALCULATION SHEET

Originator N. K. Schiffern **Date** 10/09/12 **Calc. No.** 0100D-CA-V0477 **Rev. No.** 0
Project 100-D Field Remediation **Job No.** 14655 **Checked** J. D. Skoglie **Date** 10/09/12
Subject 100-D-50:9 Subsite Service Area 2 Cleanup Verification 95% UCL Calculations **Sheet No.** 17 of 26

100-D-50:9 Subsite Maximum Calculations

Verification Data - Staging Pilea Area

Sample Area	Sample Number	Sample Date	Antimony			Mercury			Benzo(a)anthracene			Benzo(a)pyrene			Benzo(b)fluoranthene			Chrysene		
			mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
SPA-2	J1R087	8/23/2012	0.36	U	0.36	0.0061	U	0.0061	2.9	U	2.9	5.9	U	5.9	3.9	U	3.9	4.5	U	4.5
Duplicate of J1R087	J1R098	8/23/2012	0.35	U	0.35	0.0048	U	0.0048	3.1	U	3.1	6.2	U	6.2	4.1	U	4.1	4.7	U	4.7
SPA-1	J1R086	8/23/2012	0.35	U	0.35	0.0063	U	0.0063	3.2	U	3.2	6.4	U	6.4	4.2	U	4.2	4.9	U	4.9
SPA-3	J1R088	8/23/2012	0.38	U	0.38	0.0058	U	0.0058	3.0	U	3.0	6.0	U	6.0	4.5	JX	4.0	4.6	U	4.6
SPA-4	J1R089	8/23/2012	0.35	U	0.35	0.027		0.0048	3.2	U	3.2	6.4	U	6.4	5.3	J	4.2	5.1	J	4.8
SPA-5	J1R090	8/23/2012	0.34	U	0.34	0.0068	U	0.0068	3.1	U	3.1	6.3	U	6.3	4.1	U	4.1	4.8	U	4.8
SPA-6	J1R091	8/23/2012	0.36	U	0.36	0.0057	U	0.0057	3.2	U	3.2	6.4	U	6.4	4.2	U	4.2	4.8	U	4.8
SPA-7	J1R092	8/23/2012	0.32	U	0.32	0.0048	U	0.0048	3.1	U	3.1	6.1	U	6.1	4.0	U	4.0	4.6	U	4.6
SPA-8	J1R093	8/23/2012	0.37	U	0.37	0.0060	U	0.0060	3.1	U	3.1	6.1	U	6.1	4.0	U	4.0	4.6	U	4.6
SPA-9	J1R094	8/23/2012	0.93		0.35	0.0058	U	0.0058	14	J	3.1	7.0	J	6.3	11	J	4.1	17	J	4.8
SPA-10	J1R095	8/23/2012	0.34	U	0.34	0.0061	U	0.0061	2.9	U	2.9	5.9	U	5.9	3.9	U	3.9	4.5	U	4.5
SPA-11	J1R096	8/23/2012	0.32	B	0.32	0.030		0.0061	3.1	U	3.1	6.2	U	6.2	4.0	U	4.0	4.7	U	4.7
SPA-12	J1R097	8/23/2012	0.46	B	0.38	0.0055	U	0.0055	2.9	U	2.9	5.9	U	5.9	3.9	U	3.9	4.5	U	4.5

Statistical Computations

	Antimony	Mercury	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Chrysene
% < Detection limit	75%	83%	92%	92%	75%	83%
Maximum value	0.93	0.030	14	7.0	11	17
Most Stringent Cleanup Limit for nonradionuclide and RAG type (mg/kg) unless otherwise noted	5 GW & River Protection	0.33 GW & River Protection	15 ug/kg GW and River Protection	15 ug/kg GW and River Protection	15 ug/kg GW and River Protection	100 ug/kg River Protection
WAC 173-340 3-PART TEST						
Maximum > Cleanup Limit?	NA	NA	NO	NO	NO	NO
> 10% above Cleanup Limit?	NA	NA	NO	NO	NO	NO
Any sample > 2X Cleanup Limit?	NA	NA	NO	NO	NO	NO
3-Part Test Compliance?	Because all values are below background (5 mg/kg) the WAC 173-340 3-part test is not required.	Because all values are below background (0.33 mg/kg) the WAC 173-340 3-part test is not required.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.

Sample Area	Sample Number	Sample Date	Fluoranthene			Phenanthrene			Pyrene			Aroclor-1254			Aroclor-1260			4,4'-DDT		
			ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
SPA-2	J1R087	8/23/2012	12	U	12	11	U	11	11	U	11	2.5	U	2.5	4.0	JP	2.5	0.58	U	0.58
Duplicate of J1R087	J1R098	8/23/2012	13	U	13	12	U	12	12	U	12	2.5	U	2.5	3.9	JP	2.5	0.58	U	0.58
SPA-1	J1R086	8/23/2012	13	U	13	12	U	12	12	U	12	2.6	U	2.6	2.6	U	2.6	0.58	U	0.58
SPA-3	J1R088	8/23/2012	12	U	12	11	U	11	11	U	11	2.5	U	2.5	2.8	JP	2.5	0.57	U	0.57
SPA-4	J1R089	8/23/2012	13	U	13	12	U	12	12	U	12	2.6	U	2.6	2.6	U	2.6	0.57	U	0.57
SPA-5	J1R090	8/23/2012	13	U	13	12	U	12	12	U	12	2.6	U	2.6	2.6	U	2.6	0.59	U	0.59
SPA-6	J1R091	8/23/2012	13	U	13	12	U	12	12	U	12	2.5	U	2.5	2.5	U	2.5	0.57	U	0.57
SPA-7	J1R092	8/23/2012	12	U	12	11	U	11	11	U	11	2.5	U	2.5	2.5	U	2.5	0.56	U	0.56
SPA-8	J1R093	8/23/2012	12	U	12	11	U	11	11	U	11	2.6	U	2.6	2.6	U	2.6	0.58	U	0.58
SPA-9	J1R094	8/23/2012	24	J	13	26	J	12	30	J	12	3.5	JP	2.4	2.7	JP	2.4	0.57	U	0.57
SPA-10	J1R095	8/23/2012	12	U	12	11	U	11	11	U	11	9.1	JP	2.5	14		2.5	0.58	U	0.58
SPA-11	J1R096	8/23/2012	13	U	13	12	U	12	12	U	12	30	P	2.5	27	P	2.5	1.9	X	0.57
SPA-12	J1R097	8/23/2012	12	U	12	11	U	11	11	U	11	2.6	U	2.6	2.6	U	2.6	0.59	U	0.59

Statistical Computations

	Fluoranthene	Phenanthrene	Pyrene	Aroclor-1254	Aroclor-1260	4,4'-DDT
% < Detection limit	92%	92%	92%	75%	58%	92%
Maximum value	24	26	30	30	27	1.9
Most Stringent Cleanup Limit for nonradionuclide and RAG type (ug/kg)	18000 River Protection	240000 GW Protection	48000 GW Protection	17 GW and River Protection	17 GW and River Protection	3.3 River Protection
WAC 173-340 3-PART TEST						
Maximum > Cleanup Limit?	NO	NO	NO	YES	YES	NO
> 10% above Cleanup Limit?	NO	NO	NO	NO	NO	NO
Any sample > 2X Cleanup Limit?	NO	NO	NO	NO	NO	NO
3-Part Test Compliance?	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	A detailed assessment will be performed. The data set meets the 3-part test criteria when compared to the direct exposure RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.	The data set meets the 3-part test criteria when compared to the most stringent RAG.

Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator	N. K. Schiffern NKS	Date	10/09/12	Calc. No.	0100D-CA-V0477
Project	100-D Field Remediation	Job No.	14655	Checked	J. D. Skoglie JDS
Subject	100-D-50:9 Subsite Service Area 2 Cleanup Verification 95% UCL Calculations				

Rev. No. 0
Date 10/09/12
Sheet No. 18 of 26

Ecology Software (MTCAStat) Results, 100-D-50:9 Subsite Excavation

Antimony 95% UCL Calculation

DATA	ID
0.49	J1R058/J1R070
0.42	J1R059
0.62	J1R060
0.69	J1R061
0.77	J1R062
0.63	J1R063
0.52	J1R064
0.74	J1R065
0.46	J1R066
0.63	J1R067
0.64	J1R068
0.39	J1R069

Number of samples		Uncensored values	
Uncensored	12	Mean	0.58
Censored		Lognormal mean	0.58
Detection limit or PQL		Std. devn.	0.12
Method detection limit		Median	0.63
TOTAL	12	Min.	0.39
		Max.	0.77

Lognormal distribution? r-squared is: 0.948
Normal distribution? r-squared is: 0.960
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.66

Arsenic 95% UCL Calculation

DATA	ID
2.6	J1R058/J1R070
2.3	J1R059
2.3	J1R060
2.3	J1R061
2.4	J1R062
2.0	J1R063
2.1	J1R064
1.9	J1R065
2.0	J1R066
1.7	J1R067
1.9	J1R068
2.4	J1R069

Number of samples		Uncensored values	
Uncensored	12	Mean	2.2
Censored		Lognormal mean	2.2
Detection limit or PQL		Std. devn.	0.26
Method detection limit		Median	2.2
TOTAL	12	Min.	1.7
		Max.	2.6

Lognormal distribution? r-squared is: 0.954
Normal distribution? r-squared is: 0.959
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 2.3

Barium 95% UCL Calculation

DATA	ID
74.1	J1R058/J1R070
74.3	J1R059
73.5	J1R060
66.3	J1R061
71.8	J1R062
66.1	J1R063
75.9	J1R064
65.8	J1R065
66.8	J1R066
69.9	J1R067
72.0	J1R068
69.8	J1R069

Number of samples		Uncensored values	
Uncensored	12	Mean	70.5
Censored		Lognormal mean	70.5
Detection limit or PQL		Std. devn.	3.6
Method detection limit		Median	70.9
TOTAL	12	Min.	65.8
		Max.	75.9

Lognormal distribution? r-squared is: 0.930
Normal distribution? r-squared is: 0.932
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 72.5

Beryllium 95% UCL Calculation

DATA	ID
0.49	J1R058/J1R070
0.48	J1R059
0.49	J1R060
0.47	J1R061
0.45	J1R062
0.47	J1R063
0.51	J1R064
0.52	J1R065
0.50	J1R066
0.48	J1R067
0.47	J1R068
0.41	J1R069

Number of samples		Uncensored values	
Uncensored	12	Mean	0.48
Censored		Lognormal mean	0.48
Detection limit or PQL		Std. devn.	0.029
Method detection limit		Median	0.48
TOTAL	12	Min.	0.41
		Max.	0.52

Lognormal distribution? r-squared is: 0.891
Normal distribution? r-squared is: 0.912
Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 0.49

Boron 95% UCL Calculation

DATA	ID
1.2	J1R058/J1R070
1.5	J1R059
1.8	J1R060
1.3	J1R061
1.4	J1R062
0.99	J1R063
1.2	J1R064
0.96	J1R065
0.48	J1R066
0.43	J1R067
0.89	J1R068
0.97	J1R069

Number of samples		Uncensored values	
Uncensored	12	Mean	1.1
Censored		Lognormal mean	1.1
Detection limit or PQL		Std. devn.	0.40
Method detection limit		Median	1.1
TOTAL	12	Min.	0.43
		Max.	1.8

Lognormal distribution? r-squared is: 0.892
Normal distribution? r-squared is: 0.967
Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 1.3

Cadmium 95% UCL Calculation

DATA	ID
0.10	J1R058/J1R070
0.086	J1R059
0.12	J1R060
0.079	J1R061
0.085	J1R062
0.080	J1R063
0.086	J1R064
0.088	J1R065
0.11	J1R066
0.079	J1R067
0.098	J1R068
0.078	J1R069

Number of samples		Uncensored values	
Uncensored	12	Mean	0.091
Censored		Lognormal mean	0.091
Detection limit or PQL		Std. devn.	0.014
Method detection limit		Median	0.086
TOTAL	12	Min.	0.078
		Max.	0.12

Lognormal distribution? r-squared is: 0.887
Normal distribution? r-squared is: 0.863
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 0.097

Chromium 95% UCL Calculation

DATA	ID
11.6	J1R058/J1R070
12.2	J1R059
11.0	J1R060
10.4	J1R061
11.2	J1R062
9.7	J1R063
10.5	J1R064
9.7	J1R065
9.8	J1R066
9.0	J1R067
10.1	J1R068
12.0	J1R069

Number of samples		Uncensored values	
Uncensored	12	Mean	10.6
Censored		Lognormal mean	10.6
Detection limit or PQL		Std. devn.	1.0
Method detection limit		Median	10.5
TOTAL	12	Min.	9.0
		Max.	12.2

Lognormal distribution? r-squared is: 0.974
Normal distribution? r-squared is: 0.970
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 11.2

Cobalt 95% UCL Calculation

DATA	ID
7.7	J1R058/J1R070
7.8	J1R059
8.0	J1R060
8.0	J1R061
7.5	J1R062
8.0	J1R063
8.3	J1R064
8.8	J1R065
8.2	J1R066
7.9	J1R067
7.7	J1R068
7.1	J1R069

Number of samples		Uncensored values	
Uncensored	12	Mean	7.9
Censored		Lognormal mean	7.9
Detection limit or PQL		Std. devn.	0.42
Method detection limit		Median	8.0
TOTAL	12	Min.	7.1
		Max.	8.8

Lognormal distribution? r-squared is: 0.949
Normal distribution? r-squared is: 0.948
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 8.1

Copper 95% UCL Calculation

DATA	ID
15.9	J1R058/J1R070
16.5	J1R059
16.4	J1R060
16.1	J1R061
15.5	J1R062
15.0	J1R063
14.8	J1R064
15.4	J1R065
15.0	J1R066
14.1	J1R067
14.0	J1R068
14.7	J1R069

Number of samples		Uncensored values	
Uncensored	12	Mean	15.3
Censored		Lognormal mean	15.3
Detection limit or PQL		Std. devn.	0.83
Method detection limit		Median	15.2
TOTAL	12	Min.	14.0
		Max.	16.5

Lognormal distribution? r-squared is: 0.970
Normal distribution? r-squared is: 0.971
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 15.7

Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator	N. K. Schiffern	Date	10/09/12
Project	100-D Field Remediation	Job No.	14655
Subject	100-D-50:9 Subsite Service Area 2 Cleanup Verification 95% UCL Calculations		
Calc. No.	0100D-CA-V0477	Rev. No.	0
Checked	J. D. Skoglie	Date	10/09/12
		Sheet No.	19 of 26

Ecology Software (MTCAStat) Results, 100-D-50:9 Subsite Excavation

Lead 95% UCL Calculation

DATA	ID
4.5	J1R058/J1R070
5.2	J1R059
15.6	J1R060
18.3	J1R061
9.2	J1R062
4.3	J1R063
4.2	J1R064
3.7	J1R065
4.0	J1R066
3.6	J1R067
3.6	J1R068
3.7	J1R069

Number of samples		Uncensored values	
Uncensored	12	Mean	6.7
Censored		Lognormal mean	6.5
Detection limit or PQL		Std. devn.	5.1
Method detection limit		Median	4.3
TOTAL	12	Min.	3.6
		Max.	18.3

Lognormal distribution? r-squared is: 0.739
Normal distribution? r-squared is: 0.651

Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 9.1

Manganese 95% UCL Calculation

DATA	ID
323	J1R058/J1R070
321	J1R059
314	J1R060
331	J1R061
289	J1R062
336	J1R063
346	J1R064
324	J1R065
325	J1R066
320	J1R067
330	J1R068
304	J1R069

Number of samples		Uncensored values	
Uncensored	12	Mean	322
Censored		Lognormal mean	322
Detection limit or PQL		Std. devn.	14.8
Method detection limit		Median	324
TOTAL	12	Min.	289
		Max.	346

Lognormal distribution? r-squared is: 0.920
Normal distribution? r-squared is: 0.932

Recommendations:
Use lognormal distribution.

UCL (Land's method) is 330

Nickel 95% UCL Calculation

DATA	ID
12.0	J1R058/J1R070
11.9	J1R059
11.4	J1R060
10.7	J1R061
13.9	J1R062
11.0	J1R063
10.8	J1R064
12.3	J1R065
10.4	J1R066
9.7	J1R067
10.7	J1R068
11.0	J1R069

Number of samples		Uncensored values	
Uncensored	12	Mean	11.3
Censored		Lognormal mean	11.3
Detection limit or PQL		Std. devn.	1.1
Method detection limit		Median	11.0
TOTAL	12	Min.	9.7
		Max.	13.9

Lognormal distribution? r-squared is: 0.932
Normal distribution? r-squared is: 0.907

Recommendations:
Use lognormal distribution.

UCL (Land's method) is 11.9

Vanadium 95% UCL Calculation

DATA	ID
46.3	J1R058/J1R070
48.9	J1R059
54.7	J1R060
52.1	J1R061
48.4	J1R062
53.8	J1R063
52.0	J1R064
57.9	J1R065
56.2	J1R066
51.3	J1R067
50.1	J1R068
45.9	J1R069

Number of samples		Uncensored values	
Uncensored	12	Mean	51.5
Censored		Lognormal mean	51.5
Detection limit or PQL		Std. devn.	3.8
Method detection limit		Median	51.7
TOTAL	12	Min.	45.9
		Max.	57.9

Lognormal distribution? r-squared is: 0.986
Normal distribution? r-squared is: 0.986

Recommendations:
Use lognormal distribution.

UCL (Land's method) is 53.5

Zinc 95% UCL Calculation

DATA	ID
40.2	J1R058/J1R070
40.5	J1R059
42.2	J1R060
39.7	J1R061
36.4	J1R062
37.9	J1R063
40.2	J1R064
40.9	J1R065
39.5	J1R066
39.2	J1R067
38.4	J1R068
36.7	J1R069

Number of samples		Uncensored values	
Uncensored	12	Mean	39.3
Censored		Lognormal mean	39.3
Detection limit or PQL		Std. devn.	1.7
Method detection limit		Median	39.6
TOTAL	12	Min.	36.4
		Max.	42.2

Lognormal distribution? r-squared is: 0.962
Normal distribution? r-squared is: 0.967

Recommendations:
Use lognormal distribution.

UCL (Land's method) is 40.2

Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford
Originator: N. K. Schiffern NK
Project: 100-D Field Remediation
Subject: 100-D-50:9 Subsite Service Area 2 Cleanup Verification 95% UCL Calculations

Date: 10/09/12
Job No.: 14655

Calc. No.: 0100D-CA-V0477
Checked: J. D. Skoglie JD

Rev. No.: 0
Date: 10/09/12
Sheet No.: 20 of 26

Ecology Software (MTCAStat) Results, 100-D-50:9 Subsite Overburden

Arsenic 95% UCL Calculation

DATA	ID
3.0	J1R083/J1R084
2.5	J1R072
3.0	J1R073
2.6	J1R074
2.5	J1R075
2.4	J1R076
2.0	J1R077
2.6	J1R078
2.2	J1R079
2.4	J1R080
2.2	J1R081
2.4	J1R082

Number of samples		Uncensored values	
Uncensored	12	Mean	2.5
Censored		Lognormal mean	2.5
Detection limit or PQL		Std. devn.	0.30
Method detection limit		Median	2.5
TOTAL	12	Min.	2.0
		Max.	3.0

Lognormal distribution? r-squared is: 0.942
Normal distribution? r-squared is: 0.928
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 2.6

Barium 95% UCL Calculation

DATA	ID
66.7	J1R083/J1R084
62.4	J1R072
70.8	J1R073
62.4	J1R074
61.2	J1R075
64.5	J1R076
56.5	J1R077
68.4	J1R078
54.4	J1R079
68.1	J1R080
60.7	J1R081
61.6	J1R082

Number of samples		Uncensored values	
Uncensored	12	Mean	63.1
Censored		Lognormal mean	63.2
Detection limit or PQL		Std. devn.	4.9
Method detection limit		Median	62.4
TOTAL	12	Min.	54.4
		Max.	70.8

Lognormal distribution? r-squared is: 0.962
Normal distribution? r-squared is: 0.969
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 65.8

Beryllium 95% UCL Calculation

DATA	ID
0.17	J1R083/J1R084
0.086	J1R072
0.15	J1R073
0.10	J1R074
0.086	J1R075
0.12	J1R076
0.077	J1R077
0.12	J1R078
0.10	J1R079
0.087	J1R080
0.11	J1R081
0.12	J1R082

Number of samples		Uncensored values	
Uncensored	12	Mean	0.11
Censored		Lognormal mean	0.11
Detection limit or PQL		Std. devn.	0.027
Method detection limit		Median	0.11
TOTAL	12	Min.	0.077
		Max.	0.17

Lognormal distribution? r-squared is: 0.951
Normal distribution? r-squared is: 0.915
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.13

Boron 95% UCL Calculation

DATA	ID
1.3	J1R083/J1R084
1.1	J1R072
1.5	J1R073
1.1	J1R074
0.43	J1R075
1.4	J1R076
0.93	J1R077
0.99	J1R078
0.44	J1R079
0.49	J1R080
0.48	J1R081
0.43	J1R082

Number of samples		Uncensored values	
Uncensored	12	Mean	0.88
Censored		Lognormal mean	0.90
Detection limit or PQL		Std. devn.	0.41
Method detection limit		Median	0.96
TOTAL	12	Min.	0.43
		Max.	1.5

Lognormal distribution? r-squared is: 0.863
Normal distribution? r-squared is: 0.893
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 1.1

Cadmium 95% UCL Calculation

DATA	ID
0.038	J1R083/J1R084
0.036	J1R072
0.019	J1R073
0.018	J1R074
0.018	J1R075
0.020	J1R076
0.019	J1R077
0.056	J1R078
0.038	J1R079
0.046	J1R080
0.020	J1R081
0.046	J1R082

Number of samples		Uncensored values	
Uncensored	12	Mean	0.031
Censored		Lognormal mean	0.031
Detection limit or PQL		Std. devn.	0.014
Method detection limit		Median	0.028
TOTAL	12	Min.	0.018
		Max.	0.056

Lognormal distribution? r-squared is: 0.845
Normal distribution? r-squared is: 0.854
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 0.038

Chromium 95% UCL Calculation

DATA	ID
11.4	J1R083/J1R084
9.9	J1R072
10.6	J1R073
9.9	J1R074
11.0	J1R075
9.3	J1R076
9.4	J1R077
9.5	J1R078
10.1	J1R079
9.4	J1R080
9.6	J1R081
10.1	J1R082

Number of samples		Uncensored values	
Uncensored	12	Mean	10.0
Censored		Lognormal mean	10.0
Detection limit or PQL		Std. devn.	0.66
Method detection limit		Median	9.9
TOTAL	12	Min.	9.3
		Max.	11.4

Lognormal distribution? r-squared is: 0.912
Normal distribution? r-squared is: 0.901
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 10.4

Cobalt 95% UCL Calculation

DATA	ID
7.8	J1R083/J1R084
8.5	J1R072
7.7	J1R073
8.0	J1R074
8.3	J1R075
7.3	J1R076
8.1	J1R077
7.7	J1R078
6.7	J1R079
8.6	J1R080
8.2	J1R081
7.5	J1R082

Number of samples		Uncensored values	
Uncensored	12	Mean	7.9
Censored		Lognormal mean	7.9
Detection limit or PQL		Std. devn.	0.54
Method detection limit		Median	7.9
TOTAL	12	Min.	6.7
		Max.	8.6

Lognormal distribution? r-squared is: 0.942
Normal distribution? r-squared is: 0.958
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 8.2

Copper 95% UCL Calculation

DATA	ID
16.2	J1R083/J1R084
17.2	J1R072
16.7	J1R073
16.3	J1R074
16.3	J1R075
15.8	J1R076
16.1	J1R077
15.4	J1R078
13.8	J1R079
16.8	J1R080
16.5	J1R081
15.8	J1R082

Number of samples		Uncensored values	
Uncensored	12	Mean	16.1
Censored		Lognormal mean	16.1
Detection limit or PQL		Std. devn.	0.87
Method detection limit		Median	16.3
TOTAL	12	Min.	13.8
		Max.	17.2

Lognormal distribution? r-squared is: 0.813
Normal distribution? r-squared is: 0.840
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 16.5

Lead 95% UCL Calculation

DATA	ID
5.9	J1R083/J1R084
6.4	J1R072
7.0	J1R073
7.7	J1R074
4.4	J1R075
5.4	J1R076
47.6	J1R077
5.9	J1R078
4.2	J1R079
16.2	J1R080
7.6	J1R081
3.9	J1R082

Number of samples		Uncensored values	
Uncensored	12	Mean	10.2
Censored		Lognormal mean	9.4
Detection limit or PQL		Std. devn.	12.2
Method detection limit		Median	6.2
TOTAL	12	Min.	3.9
		Max.	47.6

Lognormal distribution? r-squared is: 0.753
Normal distribution? r-squared is: 0.489
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 16.0

Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford
Originator N. K. Schiffern
Project 100-D Field Remediation
Subject 100-D-50:9 Subsite Service Area 2 Cleanup Verification 95% UCL Calculations

Date 10/09/12
Job No. 14655

Calc. No. 0100D-CA-V0477
Checked J. D. Skoglie

Rev. No. 0
Date 10/09/12
Sheet No. 21 of 26

Ecology Software (MTCAStat) Results, 100-D-50:9 Subsite Overburden

Manganese 95% UCL Calculation

DATA	ID
324	J1R083/J1R084
314	J1R072
329	J1R073
309	J1R074
321	J1R075
303	J1R076
321	J1R077
310	J1R078
280	J1R079
324	J1R080
319	J1R081
299	J1R082

Number of samples
Uncensored 12
Censored
Detection limit or PQL
Method detection limit
TOTAL 12

Uncensored values	
Mean	313
Lognormal mean	313
Std. devn.	13.7
Median	317
Min.	280
Max.	329

Lognormal distribution?
r-squared is: 0.875

Normal distribution?
r-squared is: 0.890

Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 319

Nickel 95% UCL Calculation

DATA	ID
12.3	J1R083/J1R084
12.5	J1R072
11.4	J1R073
10.6	J1R074
12.7	J1R075
9.9	J1R076
9.9	J1R077
11.1	J1R078
10.5	J1R079
11.2	J1R080
11.3	J1R081
11.3	J1R082

Number of samples
Uncensored 12
Censored
Detection limit or PQL
Method detection limit
TOTAL 12

Uncensored values	
Mean	11.2
Lognormal mean	11.2
Std. devn.	0.93
Median	11.3
Min.	9.9
Max.	12.7

Lognormal distribution?
r-squared is: 0.950

Normal distribution?
r-squared is: 0.948

Recommendations:
Use lognormal distribution.

UCL (Land's method) is 11.7

Vanadium 95% UCL Calculation

DATA	ID
48.4	J1R083/J1R084
55.2	J1R072
49.3	J1R073
54.4	J1R074
54.1	J1R075
48.4	J1R076
56.3	J1R077
52.7	J1R078
43.5	J1R079
58.4	J1R080
54.3	J1R081
50.2	J1R082

Number of samples
Uncensored 12
Censored
Detection limit or PQL
Method detection limit
TOTAL 12

Uncensored values	
Mean	52.1
Lognormal mean	52.1
Std. devn.	4.2
Median	53.4
Min.	43.5
Max.	58.4

Lognormal distribution?
r-squared is: 0.937

Normal distribution?
r-squared is: 0.952

Recommendations:
Use lognormal distribution.

UCL (Land's method) is 54.5

Zinc 95% UCL Calculation

DATA	ID
41.0	J1R083/J1R084
42.7	J1R072
41.3	J1R073
45.2	J1R074
41.0	J1R075
43.3	J1R076
44.2	J1R077
42.2	J1R078
37.4	J1R079
44.8	J1R080
43.1	J1R081
39.2	J1R082

Number of samples
Uncensored 12
Censored
Detection limit or PQL
Method detection limit
TOTAL 12

Uncensored values	
Mean	42.1
Lognormal mean	42.1
Std. devn.	2.3
Median	42.5
Min.	37.4
Max.	45.2

Lognormal distribution?
r-squared is: 0.949

Normal distribution?
r-squared is: 0.959

Recommendations:
Use lognormal distribution.

UCL (Land's method) is 43.4

Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator: N. K. Schiffern
Project: 100-D Field Remediation
Subject: 100-D-50:9 Subsite Service Area 2 Cleanup Verification 95% UCL Calculations

Date: 10/09/12
Job No.: 14655

Calc. No.: 0100D-CA-V0477
Checked: J. D. Skoglie

Rev. No.: 0
Date: 10/09/12
Sheet No.: 22 of 26

Ecology Software (MTCAStat) Results, 100-D-50:9 Subsite Staging Pile Area

Arsenic 95% UCL Calculation

DATA	ID
2.5	J1R087/J1R098
2.5	J1R086
1.9	J1R088
2.6	J1R089
2.8	J1R090
1.5	J1R091
3.0	J1R092
3.1	J1R093
2.2	J1R094
1.7	J1R095
2.6	J1R096
1.8	J1R097

Number of samples		Uncensored values	
Uncensored	12	Mean	2.3
Censored		Lognormal mean	2.4
Detection limit or PQL		Std. devn.	0.52
Method detection limit		Median	2.5
TOTAL	12	Min.	1.5
		Max.	3.1

Lognormal distribution? r-squared is: 0.947
Normal distribution? r-squared is: 0.965
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 2.7

Barium 95% UCL Calculation

DATA	ID
69.9	J1R087/J1R098
58.2	J1R086
56.5	J1R088
78.1	J1R089
60.7	J1R090
52.2	J1R091
53.6	J1R092
68.1	J1R093
60.4	J1R094
58.3	J1R095
73.1	J1R096
55.7	J1R097

Number of samples		Uncensored values	
Uncensored	12	Mean	62.1
Censored		Lognormal mean	62.1
Detection limit or PQL		Std. devn.	8.3
Method detection limit		Median	59.4
TOTAL	12	Min.	52.2
		Max.	78.1

Lognormal distribution? r-squared is: 0.938
Normal distribution? r-squared is: 0.919
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 66.6

Beryllium 95% UCL Calculation

DATA	ID
0.060	J1R087/J1R098
0.056	J1R086
0.017	J1R088
0.12	J1R089
0.11	J1R090
0.016	J1R091
0.075	J1R092
0.15	J1R093
0.080	J1R094
0.015	J1R095
0.098	J1R096
0.050	J1R097

Number of samples		Uncensored values	
Uncensored	12	Mean	0.071
Censored		Lognormal mean	0.077
Detection limit or PQL		Std. devn.	0.044
Method detection limit		Median	0.068
TOTAL	12	Min.	0.015
		Max.	0.15

Lognormal distribution? r-squared is: 0.885
Normal distribution? r-squared is: 0.962
Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 0.093

Boron 95% UCL Calculation

DATA	ID
0.83	J1R087/J1R098
0.96	J1R086
0.49	J1R088
1.0	J1R089
0.92	J1R090
0.47	J1R091
0.42	J1R092
1.2	J1R093
2.0	J1R094
0.44	J1R095
2.9	J1R096
0.49	J1R097

Number of samples		Uncensored values	
Uncensored	12	Mean	1.0
Censored		Lognormal mean	1.0
Detection limit or PQL		Std. devn.	0.75
Method detection limit		Median	0.87
TOTAL	12	Min.	0.42
		Max.	2.9

Lognormal distribution? r-squared is: 0.908
Normal distribution? r-squared is: 0.765
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 1.6

Cadmium 95% UCL Calculation

DATA	ID
0.035	J1R087/J1R098
0.019	J1R086
0.021	J1R088
0.054	J1R089
0.018	J1R090
0.020	J1R091
0.062	J1R092
0.020	J1R093
0.058	J1R094
0.051	J1R095
0.067	J1R096
0.020	J1R097

Number of samples		Uncensored values	
Uncensored	12	Mean	0.037
Censored		Lognormal mean	0.038
Detection limit or PQL		Std. devn.	0.020
Method detection limit		Median	0.028
TOTAL	12	Min.	0.018
		Max.	0.067

Lognormal distribution? r-squared is: 0.827
Normal distribution? r-squared is: 0.833
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 0.046

Chromium 95% UCL Calculation

DATA	ID
9.0	J1R087/J1R098
7.9	J1R086
8.4	J1R088
9.3	J1R089
11.5	J1R090
7.2	J1R091
9.7	J1R092
11.2	J1R093
10.1	J1R094
8.4	J1R095
9.6	J1R096
9.6	J1R097

Number of samples		Uncensored values	
Uncensored	12	Mean	9.3
Censored		Lognormal mean	9.3
Detection limit or PQL		Std. devn.	1.3
Method detection limit		Median	9.5
TOTAL	12	Min.	7.2
		Max.	11.5

Lognormal distribution? r-squared is: 0.976
Normal distribution? r-squared is: 0.974
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 10.0

Cobalt 95% UCL Calculation

DATA	ID
8.6	J1R087/J1R098
8.5	J1R086
9.8	J1R088
9.5	J1R089
8.0	J1R090
9.1	J1R091
8.5	J1R092
7.6	J1R093
7.1	J1R094
8.3	J1R095
7.8	J1R096
8.0	J1R097

Number of samples		Uncensored values	
Uncensored	12	Mean	8.4
Censored		Lognormal mean	8.4
Detection limit or PQL		Std. devn.	0.78
Method detection limit		Median	8.4
TOTAL	12	Min.	7.1
		Max.	9.8

Lognormal distribution? r-squared is: 0.982
Normal distribution? r-squared is: 0.976
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 8.8

Copper 95% UCL Calculation

DATA	ID
16.2	J1R087/J1R098
17.0	J1R086
15.9	J1R088
18.1	J1R089
17.9	J1R090
15.8	J1R091
17.2	J1R092
18.1	J1R093
15.7	J1R094
16.3	J1R095
16.9	J1R096
16.3	J1R097

Number of samples		Uncensored values	
Uncensored	12	Mean	16.8
Censored		Lognormal mean	16.8
Detection limit or PQL		Std. devn.	0.89
Method detection limit		Median	16.6
TOTAL	12	Min.	15.7
		Max.	18.1

Lognormal distribution? r-squared is: 0.926
Normal distribution? r-squared is: 0.922
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 17.3

Hexavalent Chromium 95% UCL Calculation

DATA	ID
0.653	J1R087/J1R098
0.238	J1R086
0.244	J1R088
0.307	J1R089
0.0775	J1R090
0.0775	J1R091
0.0775	J1R092
0.158	J1R093
0.199	J1R094
1.41	J1R095
0.350	J1R096
0.0775	J1R097

Number of samples		Uncensored values	
Uncensored	12	Mean	0.322
Censored		Lognormal mean	0.319
Detection limit or PQL		Std. devn.	0.380
Method detection limit		Median	0.219
TOTAL	12	Min.	0.0775
		Max.	1.41

Lognormal distribution? r-squared is: 0.911
Normal distribution? r-squared is: 0.648
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.693

Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford			
Originator N. K. Schiffern	**Date** 10/09/12	**Calc. No.** 0100D-CA-V0477	**Rev. No.** 0
Project 100-D Field Remediation	**Job No.** 14655	**Checked** J. D. Skoglie	**Date** 10/09/12
Subject 100-D-50:9 Subsite Service Area 2 Cleanup Verification 95% UCL Calculations			**Sheet No.** 23 of 26

Ecology Software (MTCAStat) Results, 100-D-50:9 Subsite Staging Pile Area

Lead 95% UCL Calculation

DATA	ID
8.6	J1R087/J1R098
3.6	J1R086
27.7	J1R088
11.0	J1R089
7.6	J1R090
6.5	J1R091
4.4	J1R092
9.2	J1R093
6.2	J1R094
7.1	J1R095
23.8	J1R096
5.3	J1R097

Number of samples		Uncensored values	
Uncensored	12	Mean	10.1
Censored		Lognormal mean	10.0
Detection limit or PQL		Std. devn.	7.6
Method detection limit		Median	7.4
TOTAL	12	Min.	3.6
		Max.	27.7

Lognormal distribution? r-squared is: 0.912
Normal distribution? r-squared is: 0.726
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 15.3

Manganese 95% UCL Calculation

DATA	ID
323	J1R087/J1R098
321	J1R086
309	J1R088
413	J1R089
311	J1R090
315	J1R091
317	J1R092
304	J1R093
294	J1R094
307	J1R095
312	J1R096
292	J1R097

Number of samples		Uncensored values	
Uncensored	12	Mean	318
Censored		Lognormal mean	318
Detection limit or PQL		Std. devn.	31.3
Method detection limit		Median	312
TOTAL	12	Min.	292
		Max.	413

Lognormal distribution? r-squared is: 0.632
Normal distribution? r-squared is: 0.588
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 333

Molybdenum 95% UCL Calculation

DATA	ID
0.22	J1R087/J1R098
0.33	J1R086
0.13	J1R088
0.28	J1R089
0.12	J1R090
0.13	J1R091
0.22	J1R092
0.13	J1R093
0.42	J1R094
0.31	J1R095
0.24	J1R096
0.13	J1R097

Number of samples		Uncensored values	
Uncensored	12	Mean	0.22
Censored		Lognormal mean	0.22
Detection limit or PQL		Std. devn.	0.10
Method detection limit		Median	0.22
TOTAL	12	Min.	0.12
		Max.	0.42

Lognormal distribution? r-squared is: 0.912
Normal distribution? r-squared is: 0.904
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 0.30

Nickel 95% UCL Calculation

DATA	ID
9.8	J1R087/J1R098
9.3	J1R086
11.0	J1R088
12.0	J1R089
13.5	J1R090
10.7	J1R091
11.6	J1R092
12.5	J1R093
10.1	J1R094
10.5	J1R095
10.5	J1R096
12.4	J1R097

Number of samples		Uncensored values	
Uncensored	12	Mean	11.2
Censored		Lognormal mean	11.2
Detection limit or PQL		Std. devn.	1.3
Method detection limit		Median	10.9
TOTAL	12	Min.	9.3
		Max.	13.5

Lognormal distribution? r-squared is: 0.982
Normal distribution? r-squared is: 0.973
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 11.9

Vanadium 95% UCL Calculation

DATA	ID
62.9	J1R087/J1R098
60.3	J1R086
58.6	J1R088
56.9	J1R089
53.2	J1R090
63.4	J1R091
55.7	J1R092
47.2	J1R093
48.9	J1R094
59.2	J1R095
55.4	J1R096
57.6	J1R097

Number of samples		Uncensored values	
Uncensored	12	Mean	56.6
Censored		Lognormal mean	56.6
Detection limit or PQL		Std. devn.	5.0
Method detection limit		Median	57.3
TOTAL	12	Min.	47.2
		Max.	63.4

Lognormal distribution? r-squared is: 0.938
Normal distribution? r-squared is: 0.955
Recommendations:
Use lognormal distribution.

UCL (Land's method) is 59.4

Zinc 95% UCL Calculation

DATA	ID
46.6	J1R087/J1R098
42.3	J1R086
47.5	J1R088
45.1	J1R089
41.8	J1R090
42.3	J1R091
40.6	J1R092
38.8	J1R093
40.9	J1R094
154	J1R095
47.6	J1R096
48.2	J1R097

Number of samples		Uncensored values	
Uncensored	12	Mean	53.0
Censored		Lognormal mean	52.0
Detection limit or PQL		Std. devn.	32.0
Method detection limit		Median	43.7
TOTAL	12	Min.	38.8
		Max.	154

Lognormal distribution? r-squared is: 0.478
Normal distribution? r-squared is: 0.385
Recommendations:
Reject BOTH lognormal and normal distributions.

UCL (based on Z-statistic) is 68.2

Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern NKS	**Date** 10/09/12	**Calc. No.** 0100D-CA-V0477	**Rev. No.** 0
Project 100-D Field Remediation	**Job No.** 14655	**Checked** J. D. Skoglie JS	**Date** 10/09/12
Subject 100-D-50:9 Subsite Service Area 2 Cleanup Verification 95% UCL Calculations			**Sheet No.** 24 of 26

Duplicate Analysis - 100-D-50:9 Subsite Excavation

Sampling Area	Sample Number	Sample Date	Aluminium mg/kg	Q	PQL	Antimony mg/kg	Q	PQL	Arsenic mg/kg	Q	PQL	Barium mg/kg	Q	PQL	Beryllium mg/kg	Q	PQL	Boron mg/kg	Q	PQL	Cadmium mg/kg	Q	PQL	Calcium mg/kg	Q	PQL
EXC-1	J1R058	8/22/2012	7900		1.5	0.52	BJ	0.36	2.6		0.62	75.5		0.071	0.51		0.031	1.3	B	0.92	0.11	B	0.039	5680		13.3
Duplicate of J1R058	J1R070	8/22/2012	8030		1.4	0.46	BJ	0.34	2.6		0.59	72.7		0.068	0.46		0.029	1.0	B	0.87	0.094	B	0.037	5470		12.6

Analysis:

		Aluminium	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium
TDL		5	0.6	10	2	0.2	2	0.2	100
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	**Yes (calc RPD)**	No-Stop (acceptable)	No-Stop (acceptable)	**Yes (calc RPD)**	No-Stop (acceptable)	No-Stop (acceptable)	No-Stop (acceptable)	**Yes (calc RPD)**
	RPD	1.6%			3.8%				3.8%
	Difference > 2 TDL?	Not applicable	No - acceptable	No - acceptable	Not applicable	No - acceptable	No - acceptable	No - acceptable	Not applicable

Duplicate Analysis - 100-D-50:9 Subsite Excavation

Sampling Area	HEIS Number	Sample Date	Chromium mg/kg	Q	PQL	Cobalt mg/kg	Q	PQL	Copper mg/kg	Q	PQL	Iron mg/kg	Q	PQL	Lead mg/kg	Q	PQL	Magnesium mg/kg	Q	PQL	Manganese mg/kg	Q	PQL	Nickel mg/kg	Q	PQL
EXC-1	J1R058	8/22/2012	11.1		0.055	7.8	X	0.094	15.9		0.20	20900		3.6	4.5		0.25	4540		3.5	325		0.094	11.4		0.12
Duplicate of J1R058	J1R070	8/22/2012	12.1		0.052	7.6	X	0.089	15.9		0.19	19600		3.4	4.4		0.24	4680		3.3	321		0.089	12.6		0.11

Analysis:

		Chromium	Cobalt	Copper	Iron	Lead	Magnesium	Manganese	Nickel
TDL		1	2	1	5	5	75	5	4
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**	No-Stop (acceptable)
	RPD	8.6%		0.0%	6.4%		3.0%	1.2%	
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable

Duplicate Analysis - 100-D-50:9 Subsite Excavation

Sampling Area	HEIS Number	Sample Date	Potassium mg/kg	Q	PQL	Silicon mg/kg	Q	PQL	Sodium mg/kg	Q	PQL	Vanadium mg/kg	Q	PQL	Zinc mg/kg	Q	PQL
EXC-1	J1R058	8/22/2012	1320		38.5	253	NJ	5.3	268		55.5	48.0		0.088	40.8	X	0.37
Duplicate of J1R058	J1R070	8/22/2012	1290		36.5	242	J	5.0	241		52.6	44.6		0.084	39.5	X	0.35

Analysis:

		Potassium	Silicon	Sodium	Vanadium	Zinc
TDL		400	2	50	2.5	1
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	No-Stop (acceptable)	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**
	RPD		4.4%		7.3%	3.2%
	Difference > 2 TDL?	No - acceptable	Not applicable	No - acceptable	Not applicable	Not applicable

Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern **Date** 10/09/12 **Calc. No.** 0100D-CA-V0477 **Rev. No.** 0
Project 100-D Field Remediation **Job No.** 14655 **Checked** J. D. Skoglie **Date** 10/09/12
Subject 100-D-50:9 Subsite Service Area 2 Cleanup Verification 95% UCL Calculations **Sheet No.** 25 of 26

Duplicate Analysis - 100-D-50:9 Subsite Overburden

Sampling Area	Sample Number	Sample Date	Aluminium mg/kg	Q	PQL	Arsenic mg/kg	Q	PQL	Barium mg/kg	Q	PQL	Beryllium mg/kg	Q	PQL	Boron mg/kg	Q	PQL	Calcium mg/kg	Q	PQL	Chromium mg/kg	Q	PQL	Cobalt mg/kg	Q	PQL
OB-12	J1R083	8/23/2012	8080		1.5	2.7		0.64	68.0	X	0.074	0.17	B	0.032	1.3	B	0.96	6790	X	13.8	11.2	X	0.057	7.8	X	0.10
Duplicate of J1R083	J1R084	8/23/2012	8150		1.4	3.3		0.58	65.4	X	0.067	0.16	B	0.029	1.3	B	0.86	6830	X	12.3	11.5	X	0.051	7.8	X	0.088

Analysis:

		Aluminium	Arsenic	Barium	Beryllium	Boron	Calcium	Chromium	Cobalt
TDL		5	10	2	0.2	2	100	1	2
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**	No-Stop (acceptable)	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**	No-Stop (acceptable)
	RPD	0.9%		3.9%			0.6%	2.6%	
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	No - acceptable	Not applicable	Not applicable	No - acceptable

Duplicate Analysis - 100-D-50:9 Subsite Overburden

Sampling Area	HEIS Number	Sample Date	Copper mg/kg	Q	PQL	Iron mg/kg	Q	PQL	Lead mg/kg	Q	PQL	Magnesium mg/kg	Q	PQL	Manganese mg/kg	Q	PQL	Nickel mg/kg	Q	PQL	Potassium mg/kg	Q	PQL	Silicon mg/kg	Q	PQL
OB-12	J1R083	8/23/2012	16.4	X	0.21	21500	X	3.7	6.0		0.26	4810	X	3.6	323	X	0.098	11.7	X	0.12	1380		40.0	239		57.6
Duplicate of J1R083	J1R084	8/23/2012	16.0	X	0.19	20900	X	3.3	5.8		0.24	5000	X	3.2	324	X	0.088	12.9	X	0.11	1420		35.9	230		51.6

Analysis:

		Copper	Iron	Lead	Magnesium	Manganese	Nickel	Potassium	Silicon
TDL		1	5	5	75	5	4	400	2
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	**Yes (calc RPD)**	**Yes (calc RPD)**	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**	No-Stop (acceptable)	No-Stop (acceptable)	**Yes (calc RPD)**
	RPD	2.5%	2.8%		3.9%	0.3%			3.8%
	Difference > 2 TDL?	Not applicable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	Not applicable

Duplicate Analysis - 100-D-50:9 Subsite Overburden

Sampling Area	HEIS Number	Sample Date	Sodium mg/kg	Q	PQL	Vanadium mg/kg	Q	PQL	Zinc mg/kg	Q	PQL
OB-12	J1R083	8/23/2012	239		57.6	49.3	X	0.092	41.3	X	0.39
Duplicate of J1R083	J1R084	8/23/2012	230		51.6	47.4	X	0.082	40.7	X	0.35

Analysis:

		Sodium	Vanadium	Zinc
TDL		50	2.5	1
Duplicate Analysis	Both > PQL?	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both >5xTDL?	No-Stop (acceptable)	**Yes (calc RPD)**	**Yes (calc RPD)**
	RPD		3.9%	1.5%
	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable

Qualifiers are defined on page 3.

CALCULATION SHEET

Washington Closure Hanford

Originator N. K. Schiffern NKS **Date** 10/09/12 **Calc. No.** 0100D-CA-V0477 **Rev. No.** 0
Project 100-D Field Remediation **Job No.** 14655 **Checked** J. D. Skoglie JDS **Date** 10/09/12
Subject 100-D-50:9 Subsite Service Area 2 Cleanup Verification 95% UCL Calculations **Sheet No.** 26 of 26

Duplicate Analysis - 100-D-50:9 Staging Pile Area

Sampling Area	Sample Number	Sample Date	Aluminium			Arsenic			Barium			Beryllium			Calcium			Chromium			Cobalt			Copper		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
SPA-2	J1R087	8/23/2012	6930		1.5	2.6		0.62	73.5		0.071	0.072	B	0.031	7090		13.3	9.2		0.055	8.6	X	0.094	16.5		0.20
Duplicate of J1R087	J1R098	8/23/2012	6270		1.4	2.3		0.62	66.2		0.071	0.048	B	0.031	6830		13.2	8.7		0.054	8.6	X	0.093	15.9		0.20

Analysis:

		Aluminium	Arsenic	Barium	Beryllium	Calcium	Chromium	Cobalt	Copper
TDL		5	10	2	0.2	100	1	2	1
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)
	RPD	10.0%		10.5%		3.7%	5.6%		3.7%
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	Not applicable

Duplicate Analysis - 100-D-50:9 Staging Pile Area

Sampling Area	HEIS Number	Sample Date	Hexavalent Chromium			Iron			Lead			Magnesium			Manganese			Nickel			Potassium			Silicon		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
SPA-2	J1R087	8/23/2012	0.265		0.155	24200		3.6	9.3		0.25	4750		3.5	328		0.094	10.4	X	0.12	1120		38.6	321		5.3
Duplicate of J1R087	J1R098	8/23/2012	1.04		0.155	24300		3.5	7.9		0.25	4450		3.5	317		0.093	9.2	X	0.11	980		38.3	274		5.3

Analysis:

		Hexavalent Chromium	Iron	Lead	Magnesium	Manganese	Nickel	Potassium	Silicon
TDL		0.5	5	5	75	5	4	400	2
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)	Yes (calc RPD)
	RPD		0.4%		6.5%	3.4%			15.8%
	Difference > 2 TDL?	No - acceptable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	Not applicable

Duplicate Analysis - 100-D-50:9 Staging Pile Area

Sampling Area	HEIS Number	Sample Date	Sodium			Vanadium			Zinc			Aroclor-1260		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	ug/kg	Q	PQL
SPA-2	J1R087	8/23/2012	321		55.5	61.7		0.088	46.1		0.37	4.0	JP	2.5
Duplicate of J1R087	J1R098	8/23/2012	325		55.1	64.1		0.088	47.1		0.37	3.9	JP	2.5

Analysis:

		Sodium	Vanadium	Zinc	Aroclor-1260
TDL		50	2.5	1	20
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)
	RPD	1.2%	3.8%	2.1%	
	Difference > 2 TDL?	Not applicable	Not applicable	Not applicable	No - acceptable

Qualifiers are defined on page 3.

Attachment 1. 100-D-50:9 Subsite Service Area 2 Verification Sampling Results - Radionuclides

Sample Location	HEIS Number	Sample Date	Americium-241			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
EXC-1	J1R058	8/22/2012	0.00879	U	0.0329	0.0133	U	0.0288	-0.00967	U	0.0252	-0.0157	U	0.0502	0.00558	U	0.0950	0.0291	U	0.0474
Duplicate of J1R058	J1R070	8/22/2012	0.00114	U	0.0336	0.00625	U	0.0242	0.00752	U	0.0268	-0.0178	U	0.0503	0.0170	U	0.0860	0.0532	U	0.0511
EXC-2	J1R059	8/22/2012	-0.00332	U	0.0323	0.0251	U	0.0276	-0.0176	U	0.0239	0.00745	U	0.0511	-0.0037	U	0.0876	0.0350	U	0.0482
EXC-3	J1R060	8/22/2012	-0.00231	U	0.0327	0.0707		0.0239	-0.00493	U	0.0227	-0.0427	U	0.0487	-0.0160	U	0.0814	0.0582	U	0.0522
EXC-4	J1R061	8/22/2012	-0.0140	U	0.0311	0.0303		0.0238	0.00292	U	0.0248	-0.00815	U	0.0487	0.0210	U	0.0847	0.0318	U	0.0466
EXC-5	J1R062	8/22/2012	0.0408	U	0.0656	0.0115	U	0.0372	-0.00713	U	0.0335	-0.0189	U	0.0869	0.0264	U	0.115	0.0238	U	0.0911
EXC-6	J1R063	8/22/2012	0.00884	U	0.0404	-0.00510	U	0.0255	-0.000688	U	0.0265	-0.0256	U	0.0567	0.0111	U	0.0844	0.0440	U	0.0604
EXC-7	J1R064	8/22/2012	0.0256	U	0.0673	0.00480	U	0.0358	-0.00932	U	0.0309	-0.00240	U	0.0848	0.0112	U	0.111	0.0191	U	0.0903
EXC-8	J1R065	8/22/2012	0.0160	U	0.0404	-0.00427	U	0.0239	-0.00718	U	0.0242	0.00809	U	0.0609	0.0437	U	0.0881	0.0381	U	0.0611
EXC-9	J1R066	8/22/2012	0.00889	U	0.0292	0.0115	U	0.0248	-0.00594	U	0.0272	-0.0262	U	0.0446	0.00448	U	0.0828	0.0384	U	0.0448
EXC-10	J1R067	8/22/2012	-0.0141	U	0.0719	-0.0172	U	0.0353	-0.0125	U	0.0338	0.0827	U	0.100	-0.0386	U	0.111	-0.0176	U	0.0960
EXC-11	J1R068	8/22/2012	0.00349	U	0.114	-0.0120	U	0.0354	0.0156	U	0.0387	-0.0147	U	0.0850	0.0336	U	0.124	0.0404	U	0.0892
EXC-12	J1R069	8/22/2012	0.00720	U	0.105	-0.00138	U	0.0249	0.00493	U	0.0258	-0.0135	U	0.0641	-0.0328	U	0.0690	0.0610	U	0.0792
OB-12	J1R083	8/23/2012	-0.0340	U	0.149	0.0177	U	0.0248	0.000449	U	0.0235	0.0102	U	0.0559	-0.00295	U	0.0657	0.0259	U	0.0669
Duplicate of J1R083	J1R084	8/23/2012	-0.0333	U	0.0622	0.0454	U	0.0437	-0.00652	U	0.0319	0.0581	U	0.0904	-0.0358	U	0.0997	-0.0164	U	0.0897
OB-1	J1R072	8/23/2012	-0.00223	U	0.0224	0.00458	U	0.0186	0.00131	U	0.0209	0.00906	U	0.0394	-0.00771	U	0.0664	0.0597		0.0344
OB-2	J1R073	8/23/2012	-0.00775	U	0.0285	0.0305	U	0.0258	0.0000704	U	0.0238	-0.0254	U	0.0431	0.0449	U	0.0815	0.0303	U	0.0439
OB-3	J1R074	8/23/2012	-0.000685	U	0.0238	0.0472		0.0175	-0.000137	U	0.0212	-0.00890	U	0.0406	-0.00811	U	0.0654	0.0409	U	0.0377
OB-4	J1R075	8/23/2012	-0.116	U	0.230	0.0135	U	0.0266	0.000693	U	0.0279	0.0231	U	0.0623	-0.0160	U	0.0847	0.00572	U	0.0785
OB-5	J1R076	8/23/2012	-0.0132	U	0.0955	0.0315		0.0248	0.00490	U	0.0245	-0.0171	U	0.0601	0.0202	U	0.0783	0.0339	U	0.0748
OB-6	J1R077	8/23/2012	0.00771	U	0.0995	-0.0161	U	0.0317	-0.000204	U	0.0323	-0.0246	U	0.0797	-0.0596	U	0.0842	0.0280	U	0.0800
OB-7	J1R078	8/23/2012	-0.0185	U	0.0635	-0.0119	U	0.0350	0.0213	U	0.0409	-0.0605	U	0.0902	0.0469	U	0.120	0.0129	U	0.0907
OB-8	J1R079	8/23/2012	0.0526	U	0.0628	0.00336	U	0.0354	0.000732	U	0.0324	0.00342	U	0.0867	0.0162	U	0.110	0.0546	U	0.0880
OB-9	J1R080	8/23/2012	0.0600	U	0.0634	0.000972	U	0.0335	0.00551	U	0.0325	-0.0197	U	0.0816	0.00942	U	0.113	0.0486	U	0.0880
OB-10	J1R081	8/23/2012	0.00297	U	0.0375	0.00530	U	0.0248	0.00181	U	0.0217	0.00987	U	0.0539	-0.0354	U	0.0642	0.0190	U	0.0549
OB-11	J1R082	8/23/2012	0.0138	U	0.0284	0.105		0.0204	0.0123	U	0.0263	0.00500	U	0.0461	0.00783	U	0.0839	0.0520	U	0.0441
SPA-2	J1R087	8/23/2012	-0.00554	U	0.0437	0.00761	U	0.0295	0.00652	U	0.0295	0.0179	U	0.0647	0.0141	U	0.0814	0.0590	U	0.0647
Duplicate of J1R087	J1R098	8/23/2012	0.0113	U	0.162	0.0122	U	0.0273	0.0132	U	0.0281	-0.00890	U	0.0601	0.0302	U	0.0843	0.0389	U	0.0720
SPA-1	J1R086	8/23/2012	-0.00351	U	0.0259	0.0156	U	0.0252	0.00324	U	0.0266	-0.0143	U	0.0445	0.000279	U	0.0785	0.0274	U	0.0406
SPA-3	J1R088	8/23/2012	0.0184	U	0.154	0.0139	U	0.0262	-0.00632	U	0.0258	0.0266	U	0.0603	-0.0649	U	0.0769	0.0299	U	0.0661
SPA-4	J1R089	8/23/2012	-0.00556	U	0.0292	0.0257		0.0200	0.000458	U	0.0238	-0.0120	U	0.0453	0.0103	U	0.0735	0.0535	U	0.0467
SPA-5	J1R090	8/23/2012	-0.00680	U	0.0319	0.0587		0.0269	-0.00301	U	0.0252	0.00488	U	0.0496	0.0282	U	0.0820	0.0540	U	0.0502
SPA-6	J1R091	8/23/2012	0.0271	U	0.243	0.0153	U	0.0280	0.00698	U	0.0279	0.00714	U	0.0600	0.00103	U	0.0921	0.0533	U	0.0799
SPA-7	J1R092	8/23/2012	0.00128	U	0.0238	0.0245	U	0.0239	-0.000536	U	0.0238	0.00585	U	0.0424	-0.0143	U	0.0702	0.0390		0.0376
SPA-8	J1R093	8/23/2012	0.00954	U	0.0277	0.0294	U	0.0278	-0.00544	U	0.0251	0.000914	U	0.0472	-0.000438	U	0.0808	0.0217	U	0.0419
SPA-9	J1R094	8/23/2012	-0.00753	U	0.0389	0.0186	U	0.0280	0.00662	U	0.0244	0.0153	U	0.0572	-0.0141	U	0.0752	0.0202	U	0.0575
SPA-10	J1R095	8/23/2012	0.0138	U	0.153	0.00508	U	0.0232	-0.00374	U	0.0230	0.00269	U	0.0559	0.0152	U	0.0822	0.0115	U	0.0621
SPA-11	J1R096	8/23/2012	0.0171	U	0.0314	0.0102	U	0.0244	-0.00478	U	0.0226	-0.00927	U	0.0466	0.00890	U	0.0774	0.0568	U	0.0487
SPA-12	J1R097	8/23/2012	0.0287	U	0.257	-0.00346	U	0.0263	0.000940	U	0.0277	0.0146	U	0.0688	-0.00690	U	0.0930	0.0571	U	0.0858
FS-1	J1R071	8/22/2012	0.00590	U	0.0284	-0.00345	U	0.0211	-0.000344	U	0.0231	0.0132	U	0.0457	-0.00908	U	0.0710	0.0244	U	0.0427

Grey cells indicate not applicable or data will not be used.

Acronyms and notes apply to all of the tables in this attachment.
Note: Data qualified with B, C, J and/or X are considered acceptable values.
B = estimate
EXC = excavation
FS = focused sample
HEIS = Hanford Environmental Information System
J = estimate
MDA = minimum detected activity
N= recovery exceeds upper or lower control limits.
OB = overburden

P= >25% difefrence for detected concentrations between the two column analyses.
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyls
PEST = pesticides
PQL = practical quantitation limit
Q = qualifier
RAG = remedial action goal
SPA = staging pile area
U = undetected
X (metal) = Serial dilution in the analytical batch indicates that physical and chemical interferences are present.
X (non-metal)= more than 40 % difference between columns, lower result reported.

Attachment	1	Sheet No.	1 of 13
Originator	N. K. Schiffern *NS*	Date	12/19/12
Checked	J. D. Skoglie *JS*	Date	12/19/12
Calc. No.	0100D-CA-V0477	Rev. No.	0

Attachment 1. 100-D-50:9 Subsite Service Area 2 Verification Sampling Results - Metals

Sample Location	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-1	J1R058	8/22/2012	7900		1.5	0.52	BJ	0.36	2.6		0.62	75.5		0.071	0.51		0.031	1.3	B	0.92
Duplicate of J1R058	J1R070	8/22/2012	8030		1.4	0.46	BJ	0.34	2.6		0.59	72.7		0.068	0.46		0.029	1.0	B	0.87
EXC-2	J1R059	8/22/2012	7500		1.5	0.42	BJ	0.38	2.3		0.66	74.3		0.076	0.48		0.033	1.5	B	0.98
EXC-3	J1R060	8/22/2012	7240		1.5	0.62	J	0.37	2.3		0.64	73.5		0.073	0.49		0.032	1.8	B	0.95
EXC-4	J1R061	8/22/2012	7260		1.4	0.69	J	0.33	2.3		0.58	66.3		0.067	0.47		0.029	1.3	B	0.86
EXC-5	J1R062	8/22/2012	7360		1.3	0.77	J	0.32	2.4		0.56	71.8		0.065	0.45		0.028	1.4	B	0.84
EXC-6	J1R063	8/22/2012	6450		1.5	0.63	J	0.36	2.0		0.62	66.1		0.072	0.47		0.031	0.99	B	0.93
EXC-7	J1R064	8/22/2012	7570		1.3	0.52	J	0.33	2.1		0.57	75.9		0.066	0.51		0.029	1.2	B	0.85
EXC-8	J1R065	8/22/2012	6300		1.3	0.74	J	0.32	1.9		0.55	65.8		0.064	0.52		0.028	0.96	B	0.82
EXC-9	J1R066	8/22/2012	6610		1.5	0.46	BJ	0.37	2.0		0.64	66.8		0.073	0.50		0.032	0.95	U	0.95
EXC-10	J1R067	8/22/2012	6870		1.3	0.63	J	0.33	1.7		0.57	69.9		0.066	0.48		0.028	0.85	U	0.85
EXC-11	J1R068	8/22/2012	7240		1.4	0.64	J	0.34	1.9		0.59	72.0		0.068	0.47		0.029	0.89	B	0.87
EXC-12	J1R069	8/22/2012	6730		1.4	0.39	BJ	0.35	2.4		0.61	69.8		0.071	0.41		0.031	0.97	B	0.91
OB-12	J1R083	8/23/2012	8080		1.5	0.37	U	0.37	2.7		0.64	68.0	X	0.074	0.17	B	0.032	1.3	B	0.96
Duplicate of J1R083	J1R084	8/23/2012	8150		1.4	0.33	U	0.33	3.3		0.58	65.4	X	0.067	0.16	B	0.029	1.3	B	0.86
OB-1	J1R072	8/23/2012	6460		1.3	0.33	U	0.33	2.5		0.57	62.4	X	0.066	0.086	B	0.029	1.1	B	0.85
OB-2	J1R073	8/23/2012	7730		1.4	0.34	U	0.34	3.0		0.59	70.8	X	0.068	0.15	B	0.030	1.5	B	0.88
OB-3	J1R074	8/23/2012	6670		1.4	0.33	U	0.33	2.6		0.58	62.4	X	0.066	0.10	B	0.029	1.1	B	0.86
OB-4	J1R075	8/23/2012	6820		1.3	0.33	U	0.33	2.5		0.57	61.2	X	0.066	0.086	B	0.029	0.85	U	0.85
OB-5	J1R076	8/23/2012	7740		1.5	0.36	U	0.36	2.4		0.63	64.5	X	0.073	0.12	B	0.032	1.4	B	0.94
OB-6	J1R077	8/23/2012	7170		1.4	0.49	B	0.35	2.0		0.61	56.5	X	0.071	0.077	B	0.031	0.93	B	0.91
OB-7	J1R078	8/23/2012	7190		1.4	0.34	B	0.34	2.6		0.59	68.4	X	0.068	0.12	B	0.030	0.99	B	0.88
OB-8	J1R079	8/23/2012	6290		1.4	0.34	U	0.34	2.2		0.59	54.4	X	0.067	0.10	B	0.029	0.87	U	0.87
OB-9	J1R080	8/23/2012	7360		1.5	0.38	U	0.38	2.4		0.66	68.1	X	0.076	0.087	B	0.033	0.98	U	0.98
OB-10	J1R081	8/23/2012	7140		1.5	0.37	U	0.37	2.2		0.64	60.7	X	0.074	0.11	B	0.032	0.95	U	0.95
OB-11	J1R082	8/23/2012	6600		1.3	0.33	U	0.33	2.4		0.57	61.6	X	0.066	0.12	B	0.029	0.85	U	0.85
SPA-2	J1R087	8/23/2012	6930		1.5	0.36	U	0.36	2.6		0.62	73.5		0.071	0.072	B	0.031	1.2	B	0.92
Duplicate of J1R087	J1R098	8/23/2012	6270		1.4	0.35	U	0.35	2.3		0.62	66.2		0.071	0.048	B	0.031	0.91	U	0.91
SPA-1	J1R086	8/23/2012	6990		1.4	0.35	U	0.35	2.5		0.61	58.2		0.071	0.056	B	0.031	0.96	B	0.91
SPA-3	J1R088	8/23/2012	6060		1.5	0.38	U	0.38	1.9		0.66	56.5		0.076	0.033	U	0.033	0.98	U	0.98
SPA-4	J1R089	8/23/2012	7440		1.4	0.35	U	0.35	2.6		0.61	78.1		0.070	0.12	B	0.031	1.0	B	0.91
SPA-5	J1R090	8/23/2012	7310		1.4	0.34	U	0.34	2.8		0.59	60.7		0.068	0.11	B	0.029	0.92	B	0.87
SPA-6	J1R091	8/23/2012	5710		1.5	0.36	U	0.36	1.5		0.63	52.2		0.073	0.032	U	0.032	0.94	U	0.94
SPA-7	J1R092	8/23/2012	6820		1.3	0.32	U	0.32	3.0		0.56	53.6		0.064	0.075	B	0.028	0.83	U	0.83
SPA-8	J1R093	8/23/2012	7810		1.5	0.37	U	0.37	3.1		0.64	68.1		0.074	0.15	B	0.032	1.2	B	0.96
SPA-9	J1R094	8/23/2012	6690		1.4	0.93		0.35	2.2		0.61	60.4		0.071	0.080	B	0.031	2.0		0.91
SPA-10	J1R095	8/23/2012	5490		1.4	0.34	U	0.34	1.7		0.59	58.3		0.068	0.029	U	0.029	0.87	U	0.87
SPA-11	J1R096	8/23/2012	6820		1.3	0.32	B	0.32	2.6		0.56	73.1		0.064	0.098	B	0.028	2.9		0.83
SPA-12	J1R097	8/23/2012	6280		1.5	0.46	B	0.38	1.8		0.65	55.7		0.075	0.050	B	0.033	0.97	U	0.97
FS-1	J1R071	8/22/2012	5840		1.6	0.44	BJ	0.38	1.8		0.66	60.7		0.076	0.50		0.033	0.98	U	0.98
Equpment Blank	J1R085	8/23/2012	215		1.5	0.38	U	0.38	0.65	U	0.65	1.9	X	0.075	0.037	B	0.033	0.97	U	0.97

Attachment	1	Sheet No.	2 of 13
Originator	N. K. Schiffern	Date	10/09/12
Checked	J. D. Skoglie	Date	10/09/12
Calc. No.	0100D-CA-V0477	Rev. No.	0

Attachment 1. 100-D-50:9 Subsite Service Area 2 Verification Sampling Results - Metals

Sample Location	HEIS Number	Sample Date	Cadmium			Calcium			Chromium			Cobalt			Copper			Hexavalent Chromium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-1	J1R058	8/22/2012	0.11	B	0.039	5680		13.3	11.1		0.055	7.8	X	0.094	15.9		0.20	0.155	U	0.155
Duplicate of J1R058	J1R070	8/22/2012	0.094	B	0.037	5470		12.6	12.1		0.052	7.6	X	0.089	15.9		0.19	0.155	U	0.155
EXC-2	J1R059	8/22/2012	0.086	B	0.041	6790		14.1	12.2		0.058	7.8	X	0.10	16.5		0.22	0.265		0.155
EXC-3	J1R060	8/22/2012	0.12	B	0.040	6680		13.6	11.0		0.056	8.0	X	0.096	16.4		0.21	0.199		0.155
EXC-4	J1R061	8/22/2012	0.079	B	0.036	6240		12.4	10.4		0.051	8.0	X	0.088	16.1		0.19	0.155	U	0.155
EXC-5	J1R062	8/22/2012	0.085	B	0.035	10900		12.0	11.2		0.049	7.5	X	0.085	15.5		0.19	0.155	U	0.155
EXC-6	J1R063	8/22/2012	0.080	B	0.039	5570		13.3	9.7		0.055	8.0	X	0.095	15.0		0.21	0.155	U	0.155
EXC-7	J1R064	8/22/2012	0.086	B	0.036	4140		12.2	10.5		0.050	8.3	X	0.087	14.8		0.19	0.155	U	0.155
EXC-8	J1R065	8/22/2012	0.088	B	0.034	4830		11.8	9.7		0.049	8.8	X	0.084	15.4		0.18	0.155	U	0.155
EXC-9	J1R066	8/22/2012	0.11	B	0.040	5830		13.6	9.8		0.056	8.2	X	0.097	15.0		0.21	0.155	U	0.155
EXC-10	J1R067	8/22/2012	0.079	B	0.035	4560		12.2	9.0		0.050	7.9	X	0.086	14.1		0.19	0.155	U	0.155
EXC-11	J1R068	8/22/2012	0.098	B	0.037	4240		12.6	10.1		0.052	7.7	X	0.089	14.0		0.19	0.155	U	0.155
EXC-12	J1R069	8/22/2012	0.078	B	0.038	7400		13.1	12.0		0.054	7.1	X	0.093	14.7		0.20	0.155	U	0.155
OB-12	J1R083	8/23/2012	0.058	B	0.040	6790	X	13.8	11.2	X	0.057	7.8	X	0.098	16.4	X	0.21	0.155	U	0.155
Duplicate of J1R083	J1R084	8/23/2012	0.036	U	0.036	6830	X	12.3	11.5	X	0.051	7.8	X	0.088	16.0	X	0.19	0.155	U	0.155
OB-1	J1R072	8/23/2012	0.036	B	0.036	7340	X	12.2	9.9	X	0.050	8.5	X	0.087	17.2	X	0.19	0.155	U	0.155
OB-2	J1R073	8/23/2012	0.037	U	0.037	6870	X	12.7	10.6	X	0.052	7.7	X	0.090	16.7	X	0.19	0.155	U	0.155
OB-3	J1R074	8/23/2012	0.036	U	0.036	6390	X	12.3	9.9	X	0.051	8.0	X	0.087	16.3	X	0.19	0.155	U	0.155
OB-4	J1R075	8/23/2012	0.036	U	0.036	5840	X	12.3	11.0	X	0.050	8.3	X	0.087	16.3	X	0.19	0.155	U	0.155
OB-5	J1R076	8/23/2012	0.039	U	0.039	6220	X	13.5	9.3	X	0.055	7.3	X	0.096	15.8	X	0.21	0.214		0.155
OB-6	J1R077	8/23/2012	0.038	U	0.038	7090	X	13.1	9.4	X	0.054	8.1	X	0.093	16.1	X	0.20	0.214		0.155
OB-7	J1R078	8/23/2012	0.056	B	0.037	6540	X	12.6	9.5	X	0.052	7.7	X	0.090	15.4	X	0.19	0.258		0.155
OB-8	J1R079	8/23/2012	0.038	B	0.036	6690	X	12.5	10.1	X	0.051	6.7	X	0.089	13.8	X	0.19	0.155	U	0.155
OB-9	J1R080	8/23/2012	0.046	B	0.041	6350	X	14.0	9.4	X	0.058	8.6	X	0.10	16.8	X	0.22	0.192		0.155
OB-10	J1R081	8/23/2012	0.040	U	0.040	6780	X	13.6	9.6	X	0.056	8.2	X	0.097	16.5	X	0.21	0.155	U	0.155
OB-11	J1R082	8/23/2012	0.046	B	0.036	8440	X	12.2	10.1	X	0.050	7.5	X	0.087	15.8	X	0.19	0.155	U	0.155
SPA-2	J1R087	8/23/2012	0.039	U	0.039	7090		13.3	9.2		0.055	8.6	X	0.094	16.5		0.20	0.265		0.155
Duplicate of J1R087	J1R098	8/23/2012	0.051	B	0.038	6830		13.2	8.7		0.054	8.6	X	0.093	15.9		0.20	1.04		0.155
SPA-1	J1R086	8/23/2012	0.038	U	0.038	7710		13.1	7.9		0.054	8.5	X	0.093	17.0		0.20	0.238		0.155
SPA-3	J1R088	8/23/2012	0.041	U	0.041	5760		14.1	8.4		0.058	9.8	X	0.10	15.9		0.22	0.244		0.155
SPA-4	J1R089	8/23/2012	0.054	B	0.038	6170		13.0	9.3		0.054	9.5	X	0.092	18.1		0.20	0.307		0.155
SPA-5	J1R090	8/23/2012	0.036	U	0.036	10200		12.5	11.5		0.052	8.0	X	0.089	17.9		0.19	0.155	U	0.155
SPA-6	J1R091	8/23/2012	0.039	U	0.039	6320		13.5	7.2		0.056	9.1	X	0.096	15.8		0.21	0.155	U	0.155
SPA-7	J1R092	8/23/2012	0.062	B	0.035	8480		11.9	9.7		0.049	8.5	X	0.085	17.2		0.18	0.155	U	0.155
SPA-8	J1R093	8/23/2012	0.040	U	0.040	9350		13.8	11.2		0.057	7.6	X	0.098	18.1		0.21	0.158		0.155
SPA-9	J1R094	8/23/2012	0.058	B	0.038	6370		13.1	10.1		0.054	7.1	X	0.093	15.7		0.20	0.199		0.155
SPA-10	J1R095	8/23/2012	0.051	B	0.036	6450		12.5	8.4		0.052	8.3	X	0.089	16.3		0.19	1.41		0.155
SPA-11	J1R096	8/23/2012	0.067	B	0.035	7190		11.9	9.6		0.049	7.8	X	0.084	16.9		0.18	0.350		0.155
SPA-12	J1R097	8/23/2012	0.040	U	0.040	6030		13.9	9.6		0.057	8.0	X	0.099	16.3		0.21	0.155	U	0.155
FS-1	J1R071	8/22/2012	0.096	B	0.041	6030		14.1	8.2		0.058	8.5	X	0.10	15.8		0.22	0.155	U	0.155
Equpment Blank	J1R085	8/23/2012	0.041	U	0.041	53.8	X	14.0	0.15	BX	0.057	0.10	BX	0.099	0.35	BX	0.21			

Attachment	1	Sheet No.	3 of 13
Originator	N. K. Schiffern	Date	10/09/12
Checked	J. D. Skoglie	Date	10/09/12
Calc. No.	0100D-CA-V0477	Rev. No.	0

Attachment 1. 100-D-50:9 Subsite Service Area 2 Verification Sampling Results - Metals

Sample Location	HEIS Number	Sample Date	Iron			Lead			Magnesium			Manganese			Mercury			Molybdenum		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-1	J1R058	8/22/2012	20900		3.6	4.5		0.25	4540		3.5	325		0.094	0.0060	U	0.0060	0.24	U	0.24
Duplicate of J1R058	J1R070	8/22/2012	19600		3.4	4.4		0.24	4680		3.3	321		0.089	0.0066	U	0.0066	0.23	U	0.23
EXC-2	J1R059	8/22/2012	21500		3.8	5.2		0.27	4600		3.7	321		0.10	0.0062	U	0.0062	0.32	B	0.26
EXC-3	J1R060	8/22/2012	21400		3.7	15.6		0.26	4340		3.6	314		0.096	0.0062	U	0.0062	0.25	U	0.25
EXC-4	J1R061	8/22/2012	21500		3.3	18.3		0.24	4550		3.3	331		0.088	0.0068	U	0.0068	0.23	U	0.23
EXC-5	J1R062	8/22/2012	20300		3.2	9.2		0.23	4300		3.2	289		0.085	0.0048	U	0.0048	0.22	U	0.22
EXC-6	J1R063	8/22/2012	21600		3.6	4.3		0.26	4310		3.5	336		0.095	0.0047	U	0.0047	0.25	U	0.25
EXC-7	J1R064	8/22/2012	22700		3.3	4.2		0.23	4390		3.2	346		0.087	0.0051	U	0.0051	0.23	U	0.23
EXC-8	J1R065	8/22/2012	25300		3.2	3.7		0.23	4580		3.1	324		0.084	0.0056	U	0.0056	0.22	U	0.22
EXC-9	J1R066	8/22/2012	21600		3.7	4.0		0.26	4420		3.6	325		0.097	0.0063	U	0.0063	0.25	U	0.25
EXC-10	J1R067	8/22/2012	22400		3.3	3.6		0.23	4200		3.2	320		0.086	0.0054	U	0.0054	0.22	U	0.22
EXC-11	J1R068	8/22/2012	21300		3.4	3.6		0.24	4240		3.3	330		0.089	0.0051	U	0.0051	0.23	U	0.23
EXC-12	J1R069	8/22/2012	19200		3.5	3.7		0.25	4380		3.4	304		0.093	0.0055	U	0.0055	0.24	U	0.24
OB-12	J1R083	8/23/2012	21500	X	3.7	6.0		0.26	4810	X	3.6	323	X	0.098	0.0062	U	0.0062	0.25	U	0.25
Duplicate of J1R083	J1R084	8/23/2012	20900	X	3.3	5.8		0.24	5000	X	3.2	324	X	0.088	0.0048	U	0.0048	0.23	U	0.23
OB-1	J1R072	8/23/2012	22400	X	3.3	6.4		0.23	4820	X	3.2	314	X	0.087	0.0050	U	0.0050	0.29	B	0.23
OB-2	J1R073	8/23/2012	21200	X	3.4	7.0		0.24	4640	X	3.3	329	X	0.090	0.0055	U	0.0055	0.29	B	0.23
OB-3	J1R074	8/23/2012	22000	X	3.3	7.7		0.24	4400	X	3.2	309	X	0.087	0.0061	U	0.0061	0.23	U	0.23
OB-4	J1R075	8/23/2012	22000	X	3.3	4.4		0.23	4550	X	3.2	321	X	0.087	0.0061	U	0.0061	0.23	U	0.23
OB-5	J1R076	8/23/2012	20900	X	3.6	5.4		0.26	4350	X	3.5	303	X	0.096	0.0050	U	0.0050	0.25	U	0.25
OB-6	J1R077	8/23/2012	21400	X	3.5	47.6		0.25	4470	X	3.4	321	X	0.093	0.0067	U	0.0067	0.24	U	0.24
OB-7	J1R078	8/23/2012	20500	X	3.4	5.9		0.24	4560	X	3.3	310	X	0.090	0.0049	U	0.0049	0.23	U	0.23
OB-8	J1R079	8/23/2012	18100	X	3.4	4.2		0.24	4490	X	3.3	280	X	0.089	0.0056	U	0.0056	0.23	U	0.23
OB-9	J1R080	8/23/2012	23200	X	3.8	16.2		0.27	4660	X	3.7	324	X	0.10	0.0063	U	0.0063	0.26	U	0.26
OB-10	J1R081	8/23/2012	22200	X	3.7	7.6		0.26	4740	X	3.6	319	X	0.097	0.0067	U	0.0067	0.25	U	0.25
OB-11	J1R082	8/23/2012	20200	X	3.3	3.9		0.23	4510	X	3.2	299	X	0.087	0.0059	U	0.0059	0.23	U	0.23
SPA-2	J1R087	8/23/2012	24200		3.6	9.3		0.25	4750		3.5	328		0.094	0.0061	U	0.0061	0.31	B	0.24
Duplicate of J1R087	J1R098	8/23/2012	24300		3.5	7.9		0.25	4450		3.5	317		0.093	0.0048	U	0.0048	0.24	U	0.24
SPA-1	J1R086	8/23/2012	23900		3.5	3.6		0.25	4380		3.4	321		0.093	0.0063	U	0.0063	0.33	B	0.24
SPA-3	J1R088	8/23/2012	22400		3.8	27.7		0.27	4360		3.7	309		0.10	0.0058	U	0.0058	0.26	U	0.26
SPA-4	J1R089	8/23/2012	23200		3.5	11.0		0.25	4670		3.4	413		0.092	0.027		0.0048	0.28	B	0.24
SPA-5	J1R090	8/23/2012	21700		3.4	7.6		0.24	5230		3.3	311		0.089	0.0068	U	0.0068	0.23	U	0.23
SPA-6	J1R091	8/23/2012	24500		3.6	6.5		0.26	4630		3.5	315		0.096	0.0057	U	0.0057	0.25	U	0.25
SPA-7	J1R092	8/23/2012	22200		3.2	4.4		0.23	5010		3.1	317		0.085	0.0048	U	0.0048	0.22	B	0.22
SPA-8	J1R093	8/23/2012	20600		3.7	9.2		0.26	4840		3.6	304		0.098	0.0060	U	0.0060	0.25	U	0.25
SPA-9	J1R094	8/23/2012	20200		3.5	6.2		0.25	4670		3.4	294		0.093	0.0058	U	0.0058	0.42	B	0.24
SPA-10	J1R095	8/23/2012	22400		3.4	7.1		0.24	4340		3.3	307		0.089	0.0061	U	0.0061	0.31	B	0.23
SPA-11	J1R096	8/23/2012	21900		3.2	23.8		0.23	4410		3.1	312		0.084	0.030		0.0061	0.24	B	0.22
SPA-12	J1R097	8/23/2012	22200		3.8	5.3		0.27	4720		3.7	292		0.099	0.0055	U	0.0055	0.26	U	0.26
FS-1	J1R071	8/22/2012	23200		3.8	3.7		0.27	4310		3.7	319		0.10	0.0052	U	0.0052	0.26	U	0.26
Equipment Blank	J1R085	8/23/2012	249	X	3.8	0.28	B	0.27	27.1	X	3.7	4.7	X	0.099	0.0050	U	0.0050	0.26	U	0.26

Attachment	1	Sheet No.	4 of 13
Originator	N. K. Schiffern	Date	10/09/12
Checked	J. D. Skoglie	Date	10/09/12
Calc. No.	0100D-CA-V0477	Rev. No.	0

Attachment 1. 100-D-50:9 Subsite Service Area 2 Verification Sampling Results - Metals

Sample Location	HEIS Number	Sample Date	Nickel			Potassium			Selenium			Silicon			Silver			Sodium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
EXC-1	J1R058	8/22/2012	11.4		0.12	1320		38.5	0.81	U	0.81	253	NJ	5.3	0.15	U	0.15	268		55.5
Duplicate of J1R058	J1R070	8/22/2012	12.6		0.11	1290		36.5	0.77	U	0.77	242	J	5.0	0.14	U	0.14	241		52.6
EXC-2	J1R059	8/22/2012	11.9		0.12	1330		40.9	0.86	U	0.86	239	J	5.6	0.16	U	0.16	261		58.9
EXC-3	J1R060	8/22/2012	11.4		0.12	1330		39.5	0.83	U	0.83	254	J	5.5	0.15	U	0.15	256		56.9
EXC-4	J1R061	8/22/2012	10.7		0.11	1200		36.1	0.76	U	0.76	246	J	5.0	0.14	U	0.14	275		52.0
EXC-5	J1R062	8/22/2012	13.9		0.10	1110		35.0	0.73	U	0.73	256	J	4.8	0.14	U	0.14	264		50.3
EXC-6	J1R063	8/22/2012	11.0		0.12	1120		38.8	0.81	U	0.81	229	J	5.4	0.15	U	0.15	240		55.8
EXC-7	J1R064	8/22/2012	10.8		0.11	1410		35.5	0.75	U	0.75	247	J	4.9	0.14	U	0.14	241		51.1
EXC-8	J1R065	8/22/2012	12.3		0.10	1180		34.4	0.72	U	0.72	197	J	4.8	0.13	U	0.13	279		49.6
EXC-9	J1R066	8/22/2012	10.4		0.12	1100		39.6	0.83	U	0.83	209	J	5.5	0.15	U	0.15	272		57.0
EXC-10	J1R067	8/22/2012	9.7		0.11	1190		35.4	0.74	U	0.74	241	J	4.9	0.14	U	0.14	260		50.9
EXC-11	J1R068	8/22/2012	10.7		0.11	1350		36.5	0.77	U	0.77	236	J	5.0	0.14	U	0.14	237		52.6
EXC-12	J1R069	8/22/2012	11.0		0.11	1080		38.1	0.80	U	0.80	296	J	5.3	0.15	U	0.15	244		54.8
OB-12	J1R083	8/23/2012	11.7	X	0.12	1380		40.0	0.84	U	0.84	346		5.5	0.16	U	0.16	239		57.6
Duplicate of J1R083	J1R084	8/23/2012	12.9	X	0.11	1420		35.9	0.75	U	0.75	346		5.0	0.14	U	0.14	230		51.6
OB-1	J1R072	8/23/2012	12.5	X	0.11	1100		35.5	0.75	U	0.75	312	N	4.9	0.14	U	0.14	280		51.1
OB-2	J1R073	8/23/2012	11.4	X	0.11	1440		36.8	0.77	U	0.77	336		5.1	0.14	U	0.14	237		52.9
OB-3	J1R074	8/23/2012	10.6	X	0.11	1150		35.8	0.75	U	0.75	323		4.9	0.14	U	0.14	255		51.5
OB-4	J1R075	8/23/2012	12.7	X	0.11	1070		35.6	0.75	U	0.75	290		4.9	0.14	U	0.14	266		51.3
OB-5	J1R076	8/23/2012	9.9	X	0.12	1500		39.2	0.82	U	0.82	392		5.4	0.15	U	0.15	250		56.4
OB-6	J1R077	8/23/2012	9.9	X	0.11	1060		38.2	0.80	U	0.80	277		5.3	0.15	U	0.15	263		54.9
OB-7	J1R078	8/23/2012	11.1	X	0.11	1100		36.7	0.77	U	0.77	321		5.1	0.14	U	0.14	232		52.9
OB-8	J1R079	8/23/2012	10.5	X	0.11	981		36.4	0.76	U	0.76	270		5.0	0.14	U	0.14	250		52.4
OB-9	J1R080	8/23/2012	11.2	X	0.12	1150		40.8	0.86	U	0.86	352		5.6	0.16	U	0.16	282		58.8
OB-10	J1R081	8/23/2012	11.3	X	0.12	1130		39.7	0.83	U	0.83	311		5.5	0.15	U	0.15	253		57.1
OB-11	J1R082	8/23/2012	11.3	X	0.11	1130		35.6	0.75	U	0.75	297		4.9	0.14	U	0.14	223		51.2
SPA-2	J1R087	8/23/2012	10.4	X	0.12	1120		38.6	0.81	U	0.81	321		5.3	0.15	U	0.15	321		55.5
Duplicate of J1R087	J1R098	8/23/2012	9.2	X	0.11	980		38.3	0.80	U	0.80	274		5.3	0.15	U	0.15	325		55.1
SPA-1	J1R086	8/23/2012	9.3	X	0.11	1050		38.2	0.80	U	0.80	338	N	5.3	0.15	U	0.15	316		54.9
SPA-3	J1R088	8/23/2012	11.0	X	0.12	869		40.9	0.86	U	0.86	295		5.6	0.16	U	0.16	290		58.8
SPA-4	J1R089	8/23/2012	12.0	X	0.11	1190		37.9	0.80	U	0.80	368		5.2	0.15	U	0.15	262		54.5
SPA-5	J1R090	8/23/2012	13.5	X	0.11	1080		36.5	0.76	U	0.76	313		5.0	0.14	U	0.14	386		52.5
SPA-6	J1R091	8/23/2012	10.7	X	0.12	815		39.3	0.82	U	0.82	308		5.4	0.15	U	0.15	292		56.6
SPA-7	J1R092	8/23/2012	11.6	X	0.10	942		34.7	0.73	U	0.73	298		4.8	0.14	U	0.14	316		49.9
SPA-8	J1R093	8/23/2012	12.5	X	0.12	1150		40.0	0.84	U	0.84	401		5.5	0.16	U	0.16	261		57.6
SPA-9	J1R094	8/23/2012	10.1	X	0.11	1150		38.0	0.80	U	0.80	294		5.3	0.15	U	0.15	398		54.7
SPA-10	J1R095	8/23/2012	10.5	X	0.11	695		36.4	0.76	U	0.76	266		5.0	0.14	U	0.14	292		52.4
SPA-11	J1R096	8/23/2012	10.5	X	0.10	1080		34.6	0.73	U	0.73	312		4.8	0.13	U	0.13	268		49.8
SPA-12	J1R097	8/23/2012	12.4	X	0.12	871		40.5	0.85	U	0.85	338		5.6	0.16	U	0.16	302		58.2
FS-1	J1R071	8/22/2012	10.0		0.12	874		41.0	0.86	U	0.86	242	J	5.7	0.16	U	0.16	317		59.1
Equpment Blank	J1R085	8/23/2012	0.14	BX	0.12	45.3	B	40.6	0.85	U	0.85	145		5.6	0.16	U	0.16	58.5	U	58.5

Attachment	1	Sheet No.	5 of 13
Originator	N. K. Schiffern	Date	10/09/12
Checked	J. D. Skoglie	Date	10/09/12
Calc. No.	0100D-CA-V0477	Rev. No.	0

Attachment 1. 100-D-50:9 Subsite Service Area 2 Verification Sampling Results - Metals and Physical

Sample Location	HEIS Number	Sample Date	Vanadium			Zinc			Percent moisture (wet sample)		
			mg/kg	Q	PQL	mg/kg	Q	PQL	%	Q	PQL
EXC-1	J1R058	8/22/2012	48.0		0.088	40.8	X	0.37	0.56		0.10
Duplicate of J1R058	J1R070	8/22/2012	44.6		0.084	39.5	X	0.35	0.69		0.10
EXC-2	J1R059	8/22/2012	48.9		0.094	40.5	X	0.40	0.77		0.10
EXC-3	J1R060	8/22/2012	54.7		0.091	42.2	X	0.38	0.31		0.10
EXC-4	J1R061	8/22/2012	52.1		0.083	39.7	X	0.35	0.44		0.10
EXC-5	J1R062	8/22/2012	48.4		0.080	36.4	X	0.34	0.60		0.10
EXC-6	J1R063	8/22/2012	53.8		0.089	37.9	X	0.38	0.32		0.10
EXC-7	J1R064	8/22/2012	52.0		0.081	40.2	X	0.34	0.50		0.10
EXC-8	J1R065	8/22/2012	57.9		0.079	40.9	X	0.33	0.82		0.10
EXC-9	J1R066	8/22/2012	56.2		0.091	39.5	X	0.38	0.51		0.10
EXC-10	J1R067	8/22/2012	51.3		0.081	39.2	X	0.34	0.88		0.10
EXC-11	J1R068	8/22/2012	50.1		0.084	38.4	X	0.35	0.73		0.10
EXC-12	J1R069	8/22/2012	45.9		0.087	36.7	X	0.37	0.36		0.10
OB-12	J1R083	8/23/2012	49.3	X	0.092	41.3	X	0.39	0.55		0.10
Duplicate of J1R083	J1R084	8/23/2012	47.4	X	0.082	40.7	X	0.35	0.64		0.10
OB-1	J1R072	8/23/2012	55.2	X	0.081	42.7	X	0.35	0.55		0.10
OB-2	J1R073	8/23/2012	49.3	X	0.084	41.3	X	0.36	0.50		0.10
OB-3	J1R074	8/23/2012	54.4	X	0.082	45.2	X	0.35	0.37		0.10
OB-4	J1R075	8/23/2012	54.1	X	0.082	41.0	X	0.35	0.83		0.10
OB-5	J1R076	8/23/2012	48.4	X	0.090	43.3	X	0.38	0.37		0.10
OB-6	J1R077	8/23/2012	56.3	X	0.088	44.2	X	0.37	0.56		0.10
OB-7	J1R078	8/23/2012	52.7	X	0.084	42.2	X	0.36	0.38		0.10
OB-8	J1R079	8/23/2012	43.5	X	0.083	37.4	X	0.35	0.31		0.10
OB-9	J1R080	8/23/2012	58.4	X	0.094	44.8	X	0.40	0.60		0.10
OB-10	J1R081	8/23/2012	54.3	X	0.091	43.1	X	0.38	0.58		0.10
OB-11	J1R082	8/23/2012	50.2	X	0.082	39.2	X	0.35	0.64		0.10
SPA-2	J1R087	8/23/2012	61.7		0.088	46.1		0.37	0.63		0.10
Duplicate of J1R087	J1R098	8/23/2012	64.1		0.088	47.1		0.37	0.78		0.10
SPA-1	J1R086	8/23/2012	60.3		0.088	42.3		0.37	0.54		0.10
SPA-3	J1R088	8/23/2012	58.6		0.094	47.5		0.40	0.65		0.10
SPA-4	J1R089	8/23/2012	56.9		0.087	45.1		0.37	0.77		0.10
SPA-5	J1R090	8/23/2012	53.2		0.084	41.8		0.35	0.48		0.10
SPA-6	J1R091	8/23/2012	63.4		0.090	42.3		0.38	0.64		0.10
SPA-7	J1R092	8/23/2012	55.7		0.080	40.6		0.34	0.72		0.10
SPA-8	J1R093	8/23/2012	47.2		0.092	38.8		0.39	0.51		0.10
SPA-9	J1R094	8/23/2012	48.9		0.087	40.9		0.37	0.19		0.10
SPA-10	J1R095	8/23/2012	59.2		0.084	154		0.35	0.44		0.10
SPA-11	J1R096	8/23/2012	55.4		0.079	47.6		0.34	0.38		0.10
SPA-12	J1R097	8/23/2012	57.6		0.093	48.2		0.39	0.67		0.10
FS-1	J1R071	8/22/2012	59.8		0.094	40.9	X	0.40	1.1		0.10
Equipment Blank	J1R085	8/23/2012	0.22	BX	0.093	1.4	X	0.39	0.10		0.10

Attachment	1	Sheet No.	6 of 13
Originator	N. K. Schiffern	Date	10/09/12
Checked	J. D. Skoglie	Date	10/09/12
Calc. No.	0100D-CA-V0477	Rev. No.	0

Attachment 1. 100-D-50:9 Subsite Service Area 2 Verification Sampling Results - Organics

CONSTITUENT	CLASS	J1R058, EXC-1			J1R070, Duplicate of J1R058			J1R059, EXC-2			J1R060, EXC-3			J1R061, EXC-4			J1R062, EXC-5		
		8/22/2012			8/22/2012			8/22/2012			8/22/2012			8/22/2012			8/22/2012		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	10	U	10	9.9	U	9.9	9.8	U	9.8	9.9	U	9.9	9.9	U	9.9	10	U	10
Acenaphthylene	PAH	9.0	U	9.0	8.9	U	8.9	8.8	U	8.8	8.9	U	8.9	8.9	U	8.9	9.0	U	9.0
Anthracene	PAH	3.1	U	3.1	3.0	U	3.0	3.0	U	3.0	3.0	U	3.0	3.0	U	3.0	3.0	U	3.0
Benzo(a)anthracene	PAH	3.2	U	3.2	3.1	U	3.1	3.1	U	3.1	3.1	U	3.1	3.2	U	3.2	3.2	U	3.2
Benzo(a)pyrene	PAH	6.4	U	6.4	6.3	U	6.3	6.3	U	6.3	6.3	U	6.3	6.3	U	6.3	6.4	U	6.4
Benzo(b)fluoranthene	PAH	4.2	U	4.2	4.1	U	4.1	4.1	U	4.1	4.1	U	4.1	4.1	U	4.1	4.2	U	4.2
Benzo(ghi)perylene	PAH	7.2	U	7.2	7.1	U	7.1	7.1	U	7.1	7.1	U	7.1	7.1	U	7.1	7.2	U	7.2
Benzo(k)fluoranthene	PAH	3.9	U	3.9	3.9	U	3.9	3.9	U	3.9	3.9	U	3.9	3.9	U	3.9	3.9	U	3.9
Chrysene	PAH	4.9	U	4.9	4.8	U	4.8	4.8	U	4.8	4.8	U	4.8	4.8	U	4.8	4.8	U	4.8
Dibenz[a,h]anthracene	PAH	11	U	11	11	U	11	11	U	11	11	U	11	11	U	11	11	U	11
Fluoranthene	PAH	13	U	13	13	U	13	13	U	13	13	U	13	13	U	13	13	U	13
Fluorene	PAH	5.3	U	5.3	5.2	U	5.2	5.2	U	5.2	5.2	U	5.2	5.2	U	5.2	5.3	U	5.3
Indeno(1,2,3-cd)pyrene	PAH	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12
Naphthalene	PAH	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12
Phenanthrene	PAH	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12
Pyrene	PAH	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12
Aroclor-1016	PCB	2.8	U	2.8	2.7	U	2.7	2.7	U	2.7	2.8	U	2.8	2.7	U	2.7	2.8	U	2.8
Aroclor-1221	PCB	8.0	U	8.0	7.8	U	7.8	7.9	U	7.9	8.0	U	8.0	7.8	U	7.8	8.0	U	8.0
Aroclor-1232	PCB	2.0	U	2.0	1.9	U	1.9	2.0	U	2.0	2.0	U	2.0	2.0	U	2.0	2.0	U	2.0
Aroclor-1242	PCB	4.7	U	4.7	4.5	U	4.5	4.6	U	4.6	4.6	U	4.6	4.5	U	4.5	4.6	U	4.6
Aroclor-1248	PCB	4.7	U	4.7	4.5	U	4.5	4.6	U	4.6	4.6	U	4.6	4.5	U	4.5	4.6	U	4.6
Aroclor-1254	PCB	2.6	U	2.6	2.5	U	2.5	2.6	U	2.6	2.6	U	2.6	2.5	U	2.5	2.6	U	2.6
Aroclor-1260	PCB	2.6	U	2.6	2.5	U	2.5	2.6	U	2.6	2.6	U	2.6	2.5	U	2.5	2.6	U	2.6
Aldrin	PEST	0.25	U	0.25	0.24	U	0.24	0.25	U	0.25	0.25	U	0.25	0.25	U	0.25	0.25	U	0.25
Alpha-BHC	PEST	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21
alpha-Chlordane	PEST	0.32	U	0.32	0.31	U	0.31	0.32	U	0.32	0.32	U	0.32	0.32	U	0.32	0.32	U	0.32
beta-1,2,3,4,5,6-Hexachlorocyclohexane	PEST	0.66	U	0.66	0.65	U	0.65	0.65	U	0.65	0.65	U	0.65	0.65	U	0.65	0.67	U	0.67
Delta-BHC	PEST	0.40	U	0.40	0.39	U	0.39	0.39	U	0.39	0.39	U	0.39	0.39	U	0.39	0.40	U	0.40
4,4'-DDD	PEST	0.54	U	0.54	0.53	U	0.53	0.54	U	0.54	0.54	U	0.54	0.54	U	0.54	0.55	U	0.55
4,4'-DDE	PEST	0.24	U	0.24	0.23	U	0.23	0.23	U	0.23	0.23	U	0.23	0.23	U	0.23	0.24	U	0.24
4,4'-DDT	PEST	0.59	U	0.59	0.57	U	0.57	0.58	U	0.58	0.58	U	0.58	0.58	U	0.58	0.59	U	0.59
Dieldrin	PEST	0.21	U	0.21	0.20	U	0.20	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21
Endosulfan I	PEST	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17	0.18	U	0.18
Endosulfan II	PEST	0.28	U	0.28	0.28	U	0.28	0.28	U	0.28	0.28	U	0.28	0.28	U	0.28	0.29	U	0.29
Endosulfan sulfate	PEST	0.27	U	0.27	0.27	U	0.27	0.27	U	0.27	0.27	U	0.27	0.27	U	0.27	0.28	U	0.28
Endrin	PEST	0.30	U	0.30	0.30	U	0.30	0.30	U	0.30	0.30	U	0.30	0.30	U	0.30	0.31	U	0.31
Endrin aldehyde	PEST	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17
Endrin ketone	PEST	0.49	U	0.49	0.48	U	0.48	0.48	U	0.48	0.48	U	0.48	0.48	U	0.48	0.49	U	0.49
Gamma-BHC (Lindane)	PEST	0.46	U	0.46	0.45	U	0.45	0.46	U	0.46	0.45	U	0.45	0.46	U	0.46	0.47	U	0.47
gamma-Chlordane	PEST	0.26	U	0.26	0.26	U	0.26	0.26	U	0.26	0.26	U	0.26	0.26	U	0.26	0.27	U	0.27
Heptachlor	PEST	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21
Heptachlor epoxide	PEST	0.42	U	0.42	0.42	U	0.42	0.42	U	0.42	0.42	U	0.42	0.42	U	0.42	0.43	U	0.43
Methoxychlor	PEST	0.45	U	0.45	0.44	U	0.44	0.44	U	0.44	0.44	U	0.44	0.44	U	0.44	0.45	U	0.45
Toxaphene	PEST	16	UJ	16	15	UJ	15	16	UJ	16	15	UJ	15	16	UJ	16	16	UJ	16

Attachment	1	Sheet No.	7 of 13
Originator	N. K. Schiffern	Date	10/09/12
Checked	J. D. Skoglie	Date	10/09/12
Calc. No.	0100D-CA-V0477	Rev. No.	0

Attachment 1. 100-D-50:9 Subsite Service Area 2 Verification Sampling Results - Organics

CONSTITUENT	CLASS	J1R063, EXC-6 8/22/2012			J1R064, EXC-7 8/22/2012			J1R065, EXC-8 8/22/2012			J1R066, EXC-9 8/22/2012			J1R067, EXC-10 8/22/2012			J1R068, EXC-11 8/22/2012		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	9.9	U	9.9	10	U	10	9.7	U	9.7	9.7	U	9.7	10	U	10	9.9	U	9.9
Acenaphthylene	PAH	8.9	U	8.9	9.0	U	9.0	8.7	U	8.7	8.7	U	8.7	9.0	U	9.0	8.9	U	8.9
Anthracene	PAH	3.0	U	3.0	3.0	U	3.0	3.0	U	3.0	3.0	U	3.0	3.0	U	3.0	3.0	U	3.0
Benzo(a)anthracene	PAH	3.1	U	3.1	3.2	U	3.2	15		3.1	3.1	U	3.1	3.2	U	3.2	3.2	U	3.2
Benzo(a)pyrene	PAH	6.3	U	6.3	6.4	U	6.4	24		6.2	6.2	U	6.2	6.4	U	6.4	6.4	U	6.4
Benzo(b)fluoranthene	PAH	4.1	U	4.1	4.2	U	4.2	66		4.1	4.1	U	4.1	4.2	U	4.2	4.2	U	4.2
Benzo(ghi)perylene	PAH	7.1	U	7.1	7.2	U	7.2	40		7.0	7.0	U	7.0	7.2	U	7.2	7.2	U	7.2
Benzo(k)fluoranthene	PAH	3.9	U	3.9	3.9	U	3.9	19		3.8	3.8	U	3.8	3.9	U	3.9	3.9	U	3.9
Chrysene	PAH	4.8	U	4.8	4.8	U	4.8	68		4.7	4.7	U	4.7	4.8	U	4.8	4.8	U	4.8
Dibenz[a,h]anthracene	PAH	11	U	11	11	U	11	11	U	11	11	U	11	11	U	11	11	U	11
Fluoranthene	PAH	13	U	13	13	U	13	13	U	13	13	U	13	13	U	13	13	U	13
Fluorene	PAH	5.2	U	5.2	5.3	U	5.3	5.1	U	5.1	5.1	U	5.1	5.3	U	5.3	5.2	U	5.2
Indeno(1,2,3-cd)pyrene	PAH	12	U	12	12	U	12	39		12	12	U	12	12	U	12	12	U	12
Naphthalene	PAH	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12
Phenanthrene	PAH	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12
Pyrene	PAH	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12	12	U	12
Aroclor-1016	PCB	2.7	U	2.7	2.8	U	2.8	2.7	U	2.7	2.6	U	2.6	2.7	U	2.7	2.8	U	2.8
Aroclor-1221	PCB	7.7	U	7.7	8.0	U	8.0	7.7	U	7.7	7.7	U	7.7	7.8	U	7.8	8.1	U	8.1
Aroclor-1232	PCB	1.9	U	1.9	2.0	U	2.0	1.9	U	1.9	1.9	U	1.9	1.9	U	1.9	2.0	U	2.0
Aroclor-1242	PCB	4.5	U	4.5	4.6	U	4.6	4.5	U	4.5	4.4	U	4.4	4.5	U	4.5	4.7	U	4.7
Aroclor-1248	PCB	4.5	U	4.5	4.6	U	4.6	4.5	U	4.5	4.4	U	4.4	4.5	U	4.5	4.7	U	4.7
Aroclor-1254	PCB	2.5	U	2.5	2.6	U	2.6	2.5	U	2.5	2.5	U	2.5	2.5	U	2.5	2.6	U	2.6
Aroclor-1260	PCB	2.5	U	2.5	2.6	U	2.6	2.5	U	2.5	2.5	U	2.5	2.5	U	2.5	2.6	U	2.6
Aldrin	PEST	0.24	U	0.24	0.25	U	0.25	0.25	U	0.25	0.24	U	0.24	0.25	U	0.25	0.25	U	0.25
Alpha-BHC	PEST	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.20	U	0.20	0.21	U	0.21	0.21	U	0.21
alpha-Chlordane	PEST	0.31	U	0.31	0.32	U	0.32	0.32	U	0.32	0.31	U	0.31	0.32	U	0.32	0.32	U	0.32
beta-1,2,3,4,5,6-Hexachlorocyclohexane	PEST	0.64	U	0.64	0.65	U	0.65	0.65	U	0.65	0.63	U	0.63	0.66	U	0.66	0.65	U	0.65
Delta-BHC	PEST	0.39	U	0.39	0.40	U	0.40	0.39	U	0.39	0.38	U	0.38	0.40	U	0.40	0.39	U	0.39
4,4'-DDD	PEST	0.53	U	0.53	0.54	U	0.54	0.54	U	0.54	0.52	U	0.52	0.54	U	0.54	0.53	U	0.53
4,4'-DDE	PEST	0.23	U	0.23	0.23	U	0.23	0.23	U	0.23	0.23	U	0.23	0.24	U	0.24	0.23	U	0.23
4,4'-DDT	PEST	0.57	U	0.57	0.58	U	0.58	0.58	U	0.58	0.56	U	0.56	0.59	U	0.59	0.58	U	0.58
Dieldrin	PEST	0.20	U	0.20	0.21	U	0.21	0.21	U	0.21	0.20	U	0.20	0.21	U	0.21	0.21	U	0.21
Endosulfan I	PEST	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17	0.18	U	0.18	0.17	U	0.17
Endosulfan II	PEST	0.28	U	0.28	0.28	U	0.28	0.28	U	0.28	0.27	U	0.27	0.29	U	0.29	0.28	U	0.28
Endosulfan sulfate	PEST	0.27	U	0.27	0.27	U	0.27	0.27	U	0.27	0.26	U	0.26	0.27	U	0.27	0.27	U	0.27
Endrin	PEST	0.29	U	0.29	0.30	U	0.30	0.30	U	0.30	0.29	U	0.29	0.30	U	0.30	0.30	U	0.30
Endrin aldehyde	PEST	0.16	U	0.16	0.17	U	0.17	0.17	U	0.17	0.16	U	0.16	0.17	U	0.17	0.17	U	0.17
Endrin ketone	PEST	0.47	U	0.47	0.48	U	0.48	0.48	U	0.48	0.47	U	0.47	0.49	U	0.49	0.48	U	0.48
Gamma-BHC (Lindane)	PEST	0.45	U	0.45	0.46	U	0.46	0.46	U	0.46	0.44	U	0.44	0.46	U	0.46	0.45	U	0.45
gamma-Chlordane	PEST	0.26	U	0.26	0.26	U	0.26	0.26	U	0.26	0.25	U	0.25	0.26	U	0.26	0.26	U	0.26
Heptachlor	PEST	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.20	U	0.20	0.21	U	0.21	0.21	U	0.21
Heptachlor epoxide	PEST	0.41	U	0.41	0.42	U	0.42	0.42	U	0.42	0.41	U	0.41	0.42	U	0.42	0.42	U	0.42
Methoxychlor	PEST	0.43	U	0.43	0.44	U	0.44	0.44	U	0.44	0.43	U	0.43	0.45	U	0.45	0.44	U	0.44
Toxaphene	PEST	15	UJ	15	16	UJ	16	16	UJ	16	15	UJ	15	16	UJ	16	15	UJ	15

Attachment	1	Sheet No.	8 of 13
Originator	N. K. Schiffern	Date	10/09/12
Checked	J. D. Skoglie	Date	10/09/12
Calc. No.	0100D-CA-V0477	Rev. No.	0

Attachment 1. 100-D-50:9 Subsite Service Area 2 Verification Sampling Results - Organics

CONSTITUENT	CLASS	J1R069, EXC-12			J1R083, OB-12			J1R084, Duplicate of J1R083			J1R072, OB-1			J1R073, OB-2			J1R074, OB-3		
		8/22/2012			8/23/2012			8/23/2012			8/23/2012			8/23/2012			8/23/2012		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	9.9	U	9.9	9.6	U	9.6	9.8	U	9.8	9.9	U	9.9	9.8	U	9.8	9.5	U	9.5
Acenaphthylene	PAH	8.9	U	8.9	8.6	U	8.6	8.9	U	8.9	8.9	U	8.9	8.8	U	8.8	8.5	U	8.5
Anthracene	PAH	3.0	U	3.0	2.9	U	2.9	3.0	U	3.0	3.0	U	3.0	3.0	U	3.0	2.9	U	2.9
Benzo(a)anthracene	PAH	3.2	U	3.2	3.1	U	3.1	3.1	U	3.1	5.9	JX	3.2	3.1	U	3.1	3.0	U	3.0
Benzo(a)pyrene	PAH	6.3	U	6.3	6.1	U	6.1	6.3	U	6.3	6.4	U	6.4	6.3	U	6.3	6.1	U	6.1
Benzo(b)fluoranthene	PAH	4.2	U	4.2	4.0	U	4.0	4.2	JX	4.1	12	J	4.2	4.1	U	4.1	15		4.0
Benzo(ghi)perylene	PAH	7.1	U	7.1	6.9	U	6.9	7.1	U	7.1	7.4	JX	7.1	7.1	U	7.1	26	J	6.8
Benzo(k)fluoranthene	PAH	3.9	U	3.9	3.8	U	3.8	3.9	U	3.9	3.9	U	3.9	3.9	U	3.9	3.7	U	3.7
Chrysene	PAH	4.8	U	4.8	4.6	U	4.6	4.8	U	4.8	10	J	4.8	4.8	U	4.8	4.6	U	4.6
Dibenz[a,h]anthracene	PAH	11	U	11	11	U	11	11	U	11	11	U	11	11	U	11	10	U	10
Fluoranthene	PAH	13	U	13	12	U	12	13	U	13	23	J	13	13	U	13	12	U	12
Fluorene	PAH	5.2	U	5.2	5.1	U	5.1	5.2	U	5.2	5.2	U	5.2	5.2	U	5.2	5.0	U	5.0
Indeno(1,2,3-cd)pyrene	PAH	12	U	12	11	U	11	12	U	12	12	U	12	12	U	12	13	JX	11
Naphthalene	PAH	12	U	12	11	U	11	12	U	12	12	U	12	12	U	12	11	U	11
Phenanthrene	PAH	12	U	12	11	U	11	12	U	12	12	U	12	12	U	12	11	U	11
Pyrene	PAH	12	U	12	11	U	11	12	U	12	20	J	12	12	U	12	11	U	11
Aroclor-1016	PCB	2.6	U	2.6	2.8	U	2.8	2.7	U	2.7	2.7	U	2.7	2.7	U	2.7	2.7	U	2.7
Aroclor-1221	PCB	7.6	U	7.6	8.0	U	8.0	7.8	U	7.8	7.8	U	7.8	7.8	U	7.8	7.9	U	7.9
Aroclor-1232	PCB	1.9	U	1.9	2.0	U	2.0	1.9	U	1.9	1.9	U	1.9	2.0	U	2.0	2.0	U	2.0
Aroclor-1242	PCB	4.4	U	4.4	4.7	U	4.7	4.5	U	4.5	4.5	U	4.5	4.5	U	4.5	4.6	U	4.6
Aroclor-1248	PCB	4.4	U	4.4	4.7	U	4.7	4.5	U	4.5	4.5	U	4.5	4.5	U	4.5	4.6	U	4.6
Aroclor-1254	PCB	2.5	U	2.5	2.6	U	2.6	2.5	U	2.5	2.5	U	2.5	2.5	U	2.5	2.6	U	2.6
Aroclor-1260	PCB	2.5	U	2.5	2.6	U	2.6	2.5	U	2.5	2.5	U	2.5	2.5	U	2.5	2.6	U	2.6
Aldrin	PEST	0.25	U	0.25	0.25	U	0.25	0.25	U	0.25	0.25	U	0.25	0.25	U	0.25	0.24	U	0.24
Alpha-BHC	PEST	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21
alpha-Chlordane	PEST	0.32	U	0.32	0.32	U	0.32	0.32	U	0.32	0.32	U	0.32	0.32	U	0.32	0.31	U	0.31
beta-1,2,3,4,5,6-Hexachlorocyclohexane	PEST	0.65	U	0.65	0.66	U	0.66	0.66	U	0.66	0.66	U	0.66	0.66	U	0.66	0.64	U	0.64
Delta-BHC	PEST	0.39	U	0.39	0.40	U	0.40	0.40	U	0.40	0.40	U	0.40	0.40	U	0.40	0.39	U	0.39
4,4'-DDD	PEST	0.54	U	0.54	0.54	U	0.54	0.54	U	0.54	0.54	U	0.54	0.54	U	0.54	0.53	U	0.53
4,4'-DDE	PEST	0.23	U	0.23	0.24	U	0.24	0.24	U	0.24	0.24	U	0.24	0.24	U	0.24	0.23	U	0.23
4,4'-DDT	PEST	0.58	U	0.58	0.58	U	0.58	0.58	U	0.58	0.59	U	0.59	0.59	U	0.59	0.57	U	0.57
Dieldrin	PEST	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.20	U	0.20
Endosulfan I	PEST	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17	0.18	U	0.18	0.17	U	0.17	0.17	U	0.17
Endosulfan II	PEST	0.28	U	0.28	0.28	U	0.28	0.28	U	0.28	0.29	U	0.29	0.28	U	0.28	0.28	U	0.28
Endosulfan sulfate	PEST	0.27	U	0.27	0.27	U	0.27	0.27	U	0.27	0.27	U	0.27	0.27	U	0.27	0.27	U	0.27
Endrin	PEST	0.30	U	0.30	0.30	U	0.30	0.30	U	0.30	0.30	U	0.30	0.30	U	0.30	0.30	U	0.30
Endrin aldehyde	PEST	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17
Endrin ketone	PEST	0.48	U	0.48	0.48	U	0.48	0.48	U	0.48	0.49	U	0.49	0.49	U	0.49	0.47	U	0.47
Gamma-BHC (Lindane)	PEST	0.46	U	0.46	0.46	U	0.46	0.46	U	0.46	0.46	U	0.46	0.46	U	0.46	0.45	U	0.45
gamma-Chlordane	PEST	0.26	U	0.26	0.26	U	0.26	0.26	U	0.26	0.26	U	0.26	0.26	U	0.26	0.26	U	0.26
Heptachlor	PEST	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21
Heptachlor epoxide	PEST	0.42	U	0.42	0.42	U	0.42	0.42	U	0.42	0.42	U	0.42	0.42	U	0.42	0.41	U	0.41
Methoxychlor	PEST	0.44	U	0.44	0.45	U	0.45	0.45	U	0.45	0.45	U	0.45	0.45	U	0.45	0.44	U	0.44
Toxaphene	PEST	15	UJ	15	16	U	16	16	U	16	16	U	16	16	U	16	15	U	15

Attachment	1	Sheet No.	9 of 13
Originator	N. K. Schiffern	Date	10/09/12
Checked	J. D. Skoglie	Date	10/09/12
Calc. No.	0100D-CA-V0477	Rev. No.	0

Attachment 1. 100-D-50:9 Subsite Service Area 2 Verification Sampling Results - Organics

CONSTITUENT	CLASS	J1R075, OB-4			J1R076, OB-5			J1R077, OB-6			J1R078, OB-7			J1R079, OB-8			J1R080, OB-9		
		8/23/2012			8/23/2012			8/23/2012			8/23/2012			8/23/2012			8/23/2012		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	9.9	U	9.9	9.7	U	9.7	9.8	U	9.8	9.4	U	9.4	9.3	U	9.3	9.7	U	9.7
Acenaphthylene	PAH	8.9	U	8.9	8.7	U	8.7	8.8	U	8.8	8.5	U	8.5	8.4	U	8.4	8.7	U	8.7
Anthracene	PAH	3.0	U	3.0	2.9	U	2.9	3.0	U	3.0	2.9	U	2.9	2.8	U	2.8	3.0	U	3.0
Benzo(a)anthracene	PAH	3.1	U	3.1	3.1	U	3.1	3.1	U	3.1	3.0	U	3.0	3.0	U	3.0	3.1	U	3.1
Benzo(a)pyrene	PAH	6.3	U	6.3	6.2	U	6.2	6.3	U	6.3	6.0	U	6.0	6.0	U	6.0	6.2	U	6.2
Benzo(b)fluoranthene	PAH	4.1	U	4.1	4.1	U	4.1	4.1	U	4.1	4.0	U	4.0	4.8	J	3.9	4.1	U	4.1
Benzo(ghi)perylene	PAH	7.1	U	7.1	6.9	U	6.9	7.1	U	7.1	6.8	U	6.8	6.7	U	6.7	7.0	U	7.0
Benzo(k)fluoranthene	PAH	3.9	U	3.9	3.8	U	3.8	3.9	U	3.9	3.7	U	3.7	3.7	U	3.7	3.8	U	3.8
Chrysene	PAH	4.8	U	4.8	4.7	U	4.7	4.8	U	4.8	4.6	U	4.6	4.5	U	4.5	4.7	U	4.7
Dibenz[a,h]anthracene	PAH	11	U	11	11	U	11	11	U	11	10	U	10	10	U	10	11	U	11
Fluoranthene	PAH	13	U	13	13	U	13	13	U	13	12	U	12	12	U	12	13	U	13
Fluorene	PAH	5.2	U	5.2	5.1	U	5.1	5.2	U	5.2	5.0	U	5.0	4.9	U	4.9	5.1	U	5.1
Indeno(1,2,3-cd)pyrene	PAH	12	U	12	12	U	12	12	U	12	11	U	11	11	U	11	12	U	12
Naphthalene	PAH	12	U	12	12	U	12	12	U	12	11	U	11	11	U	11	12	U	12
Phenanthrene	PAH	12	U	12	12	U	12	12	U	12	11	U	11	11	U	11	12	U	12
Pyrene	PAH	12	U	12	12	U	12	12	U	12	11	U	11	11	U	11	12	U	12
Aroclor-1016	PCB	2.7	U	2.7	2.7	U	2.7	2.7	U	2.7	2.7	U	2.7	2.7	U	2.7	2.7	U	2.7
Aroclor-1221	PCB	7.9	U	7.9	7.7	U	7.7	7.8	U	7.8	7.8	U	7.8	7.9	U	7.9	7.8	U	7.8
Aroclor-1232	PCB	2.0	U	2.0	1.9	U	1.9	1.9	U	1.9	1.9	U	1.9	2.0	U	2.0	1.9	U	1.9
Aroclor-1242	PCB	4.6	U	4.6	4.5	U	4.5	4.5	U	4.5	4.5	U	4.5	4.6	U	4.6	4.5	U	4.5
Aroclor-1248	PCB	4.6	U	4.6	4.5	U	4.5	4.5	U	4.5	4.5	U	4.5	4.6	U	4.6	4.5	U	4.5
Aroclor-1254	PCB	2.5	U	2.5	2.5	U	2.5	2.5	U	2.5	2.5	U	2.5	2.6	U	2.6	2.5	U	2.5
Aroclor-1260	PCB	2.5	U	2.5	2.5	U	2.5	2.5	U	2.5	2.5	U	2.5	2.6	U	2.6	2.5	U	2.5
Aldrin	PEST	0.25	U	0.25	0.25	U	0.25	0.25	U	0.25	0.25	U	0.25	0.24	U	0.24	0.23	U	0.23
Alpha-BHC	PEST	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.20	U	0.20
alpha-Chlordane	PEST	0.32	U	0.32	0.32	U	0.32	0.32	U	0.32	0.32	U	0.32	0.31	U	0.31	0.30	U	0.30
beta-1,2,3,4,5,6-Hexachlorocyclohexane	PEST	0.66	U	0.66	0.65	U	0.65	0.66	U	0.66	0.66	U	0.66	0.64	U	0.64	0.61	U	0.61
Delta-BHC	PEST	0.40	U	0.40	0.39	U	0.39	0.40	U	0.40	0.40	U	0.40	0.39	U	0.39	0.37	U	0.37
4,4'-DDD	PEST	0.55	U	0.55	0.53	U	0.53	0.54	U	0.54	0.55	U	0.55	0.52	U	0.52	0.51	U	0.51
4,4'-DDE	PEST	0.24	U	0.24	0.23	U	0.23	0.24	U	0.24	0.24	U	0.24	0.23	U	0.23	0.22	U	0.22
4,4'-DDT	PEST	0.59	U	0.59	0.58	U	0.58	0.59	U	0.59	0.59	U	0.59	0.57	U	0.57	0.55	U	0.55
Dieldrin	PEST	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.20	U	0.20	0.19	U	0.19
Endosulfan I	PEST	0.18	U	0.18	0.17	U	0.17	0.18	U	0.18	0.18	U	0.18	0.17	U	0.17	0.16	U	0.16
Endosulfan II	PEST	0.29	U	0.29	0.28	U	0.28	0.29	U	0.29	0.29	U	0.29	0.28	U	0.28	0.27	U	0.27
Endosulfan sulfate	PEST	0.28	U	0.28	0.27	U	0.27	0.27	U	0.27	0.28	U	0.28	0.27	U	0.27	0.26	U	0.26
Endrin	PEST	0.31	U	0.31	0.30	U	0.30	0.30	U	0.30	0.31	U	0.31	0.29	U	0.29	0.28	U	0.28
Endrin aldehyde	PEST	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17	0.16	U	0.16	0.16	U	0.16
Endrin ketone	PEST	0.49	U	0.49	0.48	U	0.48	0.49	U	0.49	0.49	U	0.49	0.47	U	0.47	0.45	U	0.45
Gamma-BHC (Lindane)	PEST	0.46	U	0.46	0.45	U	0.45	0.46	U	0.46	0.46	U	0.46	0.45	U	0.45	0.43	U	0.43
gamma-Chlordane	PEST	0.27	U	0.27	0.26	U	0.26	0.26	U	0.26	0.27	U	0.27	0.26	U	0.26	0.25	U	0.25
Heptachlor	PEST	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.20	U	0.20
Heptachlor epoxide	PEST	0.43	U	0.43	0.42	U	0.42	0.42	U	0.42	0.43	U	0.43	0.41	U	0.41	0.39	U	0.39
Methoxychlor	PEST	0.45	U	0.45	0.44	U	0.44	0.45	U	0.45	0.45	U	0.45	0.43	U	0.43	0.42	U	0.42
Toxaphene	PEST	16	U	16	15	U	15	16	U	16	16	U	16	15	U	15	15	U	15

Attachment	1	Sheet No.	10 of 13
Originator	N. K. Schiffern	Date	10/09/12
Checked	J. D. Skoglie	Date	10/09/12
Calc. No.	0100D-CA-V0477	Rev. No.	0

Attachment 1. 100-D-50:9 Subsite Service Area 2 Verification Sampling Results - Organics

CONSTITUENT	CLASS	J1R081, OB-10			J1R082, OB-11			J1R087, SPA-2			J1R098, Duplicate of J1R087			J1R086, SPA-1			J1R088, SPA-3		
		8/23/12 11:45			8/23/12 11:55			8/23/12 7:55			8/23/12 7:55			8/23/12 7:40			8/23/12 8:10		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	9.8	U	9.8	9.8	U	9.8	9.2	U	9.2	9.7	U	9.7	10	U	10	9.4	U	9.4
Acenaphthylene	PAH	8.8	U	8.8	8.8	U	8.8	8.3	U	8.3	8.7	U	8.7	9.0	U	9.0	8.5	U	8.5
Anthracene	PAH	3.0	U	3.0	3.0	U	3.0	2.8	U	2.8	3.0	U	3.0	3.1	U	3.1	2.9	U	2.9
Benzo(a)anthracene	PAH	3.1	U	3.1	3.1	U	3.1	2.9	U	2.9	3.1	U	3.1	3.2	U	3.2	3.0	U	3.0
Benzo(a)pyrene	PAH	6.3	U	6.3	6.3	U	6.3	5.9	U	5.9	6.2	U	6.2	6.4	U	6.4	6.0	U	6.0
Benzo(b)fluoranthene	PAH	4.1	U	4.1	4.1	U	4.1	3.9	U	3.9	4.1	U	4.1	4.2	U	4.2	4.5	JX	4.0
Benzo(ghi)perylene	PAH	7.0	U	7.0	7.1	U	7.1	6.6	U	6.6	7.0	U	7.0	7.2	U	7.2	6.8	U	6.8
Benzo(k)fluoranthene	PAH	3.8	U	3.8	3.9	U	3.9	3.6	U	3.6	3.8	U	3.8	3.9	U	3.9	3.7	U	3.7
Chrysene	PAH	4.7	U	4.7	4.7	U	4.7	4.5	U	4.5	4.7	U	4.7	4.9	U	4.9	4.6	U	4.6
Dibenz[a,h]anthracene	PAH	11	U	11	11	U	11	10	U	10	11	U	11	11	U	11	10	U	10
Fluoranthene	PAH	13	U	13	13	U	13	12	U	12	13	U	13	13	U	13	12	U	12
Fluorene	PAH	5.2	U	5.2	5.2	U	5.2	4.9	U	4.9	5.1	U	5.1	5.3	U	5.3	5.0	U	5.0
Indeno(1,2,3-cd)pyrene	PAH	12	U	12	12	U	12	11	U	11	12	U	12	12	U	12	11	U	11
Naphthalene	PAH	12	U	12	12	U	12	11	U	11	12	U	12	12	U	12	11	U	11
Phenanthrene	PAH	12	U	12	12	U	12	11	U	11	12	U	12	12	U	12	11	U	11
Pyrene	PAH	12	U	12	12	U	12	11	U	11	12	U	12	12	U	12	11	U	11
Aroclor-1016	PCB	2.7	U	2.7	2.8	U	2.8	2.7	U	2.7	2.7	U	2.7	2.8	U	2.8	2.7	U	2.7
Aroclor-1221	PCB	8.0	U	8.0	8.1	U	8.1	7.8	U	7.8	7.7	U	7.7	8.0	U	8.0	7.8	U	7.8
Aroclor-1232	PCB	2.0	U	2.0	2.0	U	2.0	1.9	U	1.9	1.9	U	1.9	2.0	U	2.0	1.9	U	1.9
Aroclor-1242	PCB	4.6	U	4.6	4.7	U	4.7	4.5	U	4.5	4.5	U	4.5	4.7	U	4.7	4.5	U	4.5
Aroclor-1248	PCB	4.6	U	4.6	4.7	U	4.7	4.5	U	4.5	4.5	U	4.5	4.7	U	4.7	4.5	U	4.5
Aroclor-1254	PCB	2.6	U	2.6	2.6	U	2.6	2.5	U	2.5	2.5	U	2.5	2.6	U	2.6	2.5	U	2.5
Aroclor-1260	PCB	2.6	U	2.6	2.6	U	2.6	4.0	JP	2.5	3.9	JP	2.5	2.6	U	2.6	2.8	JP	2.5
Aldrin	PEST	0.25	U	0.25	0.25	U	0.25	0.25	U	0.25	0.25	U	0.25	0.25	U	0.25	0.24	U	0.24
Alpha-BHC	PEST	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21
alpha-Chlordane	PEST	0.32	U	0.32	0.32	U	0.32	0.32	U	0.32	0.32	U	0.32	0.32	U	0.32	0.31	U	0.31
beta-1,2,3,4,5,6-Hexachlorocyclohexane	PEST	0.66	U	0.66	0.65	U	0.65	0.66	U	0.66	0.66	U	0.66	0.65	U	0.65	0.65	U	0.65
Delta-BHC	PEST	0.40	U	0.40	0.39	U	0.39	0.40	U	0.40	0.40	U	0.40	0.40	U	0.40	0.39	U	0.39
4,4'-DDD	PEST	0.55	U	0.55	0.54	U	0.54	0.54	U	0.54	0.54	U	0.54	0.54	U	0.54	0.53	U	0.53
4,4'-DDE	PEST	0.24	U	0.24	0.23	U	0.23	0.24	U	0.24	0.24	U	0.24	0.23	U	0.23	0.23	U	0.23
4,4'-DDT	PEST	0.59	U	0.59	0.58	U	0.58	0.58	U	0.58	0.58	U	0.58	0.58	U	0.58	0.57	U	0.57
Dieldrin	PEST	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.20	U	0.20
Endosulfan I	PEST	0.18	U	0.18	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17
Endosulfan II	PEST	0.29	U	0.29	0.28	U	0.28	0.28	U	0.28	0.28	U	0.28	0.28	U	0.28	0.28	U	0.28
Endosulfan sulfate	PEST	0.28	U	0.28	0.27	U	0.27	0.27	U	0.27	0.27	U	0.27	0.27	U	0.27	0.27	U	0.27
Endrin	PEST	0.31	U	0.31	0.30	U	0.30	0.30	U	0.30	0.30	U	0.30	0.30	U	0.30	0.30	U	0.30
Endrin aldehyde	PEST	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17
Endrin ketone	PEST	0.49	U	0.49	0.48	U	0.48	0.48	U	0.48	0.48	U	0.48	0.48	U	0.48	0.48	U	0.48
Gamma-BHC (Lindane)	PEST	0.46	U	0.46	0.46	U	0.46	0.46	U	0.46	0.46	U	0.46	0.46	U	0.46	0.45	U	0.45
gamma-Chlordane	PEST	0.27	U	0.27	0.26	U	0.26	0.26	U	0.26	0.26	U	0.26	0.26	U	0.26	0.26	U	0.26
Heptachlor	PEST	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21
Heptachlor epoxide	PEST	0.43	U	0.43	0.42	U	0.42	0.42	U	0.42	0.42	U	0.42	0.42	U	0.42	0.41	U	0.41
Methoxychlor	PEST	0.45	U	0.45	0.44	U	0.44	0.45	U	0.45	0.45	U	0.45	0.44	U	0.44	0.44	U	0.44
Toxaphene	PEST	16	U	16	16	U	16	16	U	16	16	U	16	16	U	16	15	U	15

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Originator	N. K. Schiffern	Date	10/09/12
Checked	J. D. Skoglie	Date	10/09/12
Calc. No.	0100D-CA-V0477	Rev. No.	0

Attachment 1. 100-D-50:9 Subsite Service Area 2 Verification Sampling Results - Organics

CONSTITUENT	CLASS	J1R089, SPA-4			J1R090, SPA-5			J1R091, SPA-6			J1R092, SPA-7			J1R093, SPA-8			J1R094, SPA-9		
		8/23/2012			8/23/2012			8/23/2012			8/23/2012			8/23/2012			8/23/2012		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	9.9	U	9.9	9.8	U	9.8	10	U	10	9.6	U	9.6	9.6	U	9.6	9.9	U	9.9
Acenaphthylene	PAH	9.0	U	9.0	8.8	U	8.8	9.0	U	9.0	8.6	U	8.6	8.6	U	8.6	8.9	U	8.9
Anthracene	PAH	3.0	U	3.0	3.0	U	3.0	3.0	U	3.0	2.9	U	2.9	2.9	U	2.9	3.0	U	3.0
Benzo(a)anthracene	PAH	3.2	U	3.2	3.1	U	3.1	3.2	U	3.2	3.1	U	3.1	3.1	U	3.1	14	J	3.1
Benzo(a)pyrene	PAH	6.4	U	6.4	6.3	U	6.3	6.4	U	6.4	6.1	U	6.1	6.1	U	6.1	7.0	J	6.3
Benzo(b)fluoranthene	PAH	5.3	J	4.2	4.1	U	4.1	4.2	U	4.2	4.0	U	4.0	4.0	U	4.0	11	J	4.1
Benzo(ghi)perylene	PAH	7.2	U	7.2	7.1	U	7.1	7.2	U	7.2	6.9	U	6.9	6.9	U	6.9	7.1	U	7.1
Benzo(k)fluoranthene	PAH	3.9	U	3.9	3.9	U	3.9	3.9	U	3.9	3.8	U	3.8	3.8	U	3.8	3.9	U	3.9
Chrysene	PAH	5.1	J	4.8	4.8	U	4.8	4.8	U	4.8	4.6	U	4.6	4.6	U	4.6	17	J	4.8
Dibenz[a,h]anthracene	PAH	11	U	11	11	U	11	11	U	11	11	U	11	11	U	11	11	U	11
Fluoranthene	PAH	13	U	13	13	U	13	13	U	13	12	U	12	12	U	12	24	J	13
Fluorene	PAH	5.3	U	5.3	5.2	U	5.2	5.3	U	5.3	5.0	U	5.0	5.1	U	5.1	5.2	U	5.2
Indeno(1,2,3-cd)pyrene	PAH	12	U	12	12	U	12	12	U	12	11	U	11	11	U	11	12	U	12
Naphthalene	PAH	12	U	12	12	U	12	12	U	12	11	U	11	11	U	11	12	U	12
Phenanthrene	PAH	12	U	12	12	U	12	12	U	12	11	U	11	11	U	11	26	J	12
Pyrene	PAH	12	U	12	12	U	12	12	U	12	11	U	11	11	U	11	30	J	12
Aroclor-1016	PCB	2.7	U	2.7	2.8	U	2.8	2.7	U	2.7	2.7	U	2.7	2.7	U	2.7	2.6	U	2.6
Aroclor-1221	PCB	7.9	U	7.9	8.0	U	8.0	7.7	U	7.7	7.7	U	7.7	7.9	U	7.9	7.5	U	7.5
Aroclor-1232	PCB	2.0	U	2.0	2.0	U	2.0	1.9	U	1.9	1.9	U	1.9	2.0	U	2.0	1.9	U	1.9
Aroclor-1242	PCB	4.6	U	4.6	4.7	U	4.7	4.5	U	4.5	4.5	U	4.5	4.6	U	4.6	4.4	U	4.4
Aroclor-1248	PCB	4.6	U	4.6	4.7	U	4.7	4.5	U	4.5	4.5	U	4.5	4.6	U	4.6	4.4	U	4.4
Aroclor-1254	PCB	2.6	U	2.6	2.6	U	2.6	2.5	U	2.5	2.5	U	2.5	2.6	U	2.6	3.5	JP	2.4
Aroclor-1260	PCB	2.6	U	2.6	2.6	U	2.6	2.5	U	2.5	2.5	U	2.5	2.6	U	2.6	2.7	JP	2.4
Aldrin	PEST	0.24	U	0.24	0.25	U	0.25	0.24	U	0.24	0.24	U	0.24	0.25	U	0.25	0.24	U	0.24
Alpha-BHC	PEST	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.20	U	0.20	0.21	U	0.21	0.21	U	0.21
alpha-Chlordane	PEST	0.31	U	0.31	0.32	U	0.32	0.31	U	0.31	0.31	U	0.31	0.32	U	0.32	0.31	U	0.31
beta-1,2,3,4,5,6-Hexachlorocyclohexane	PEST	0.64	U	0.64	0.66	U	0.66	0.64	U	0.64	0.63	U	0.63	0.65	U	0.65	0.65	U	0.65
Delta-BHC	PEST	0.39	U	0.39	0.40	U	0.40	0.39	U	0.39	0.38	U	0.38	0.40	U	0.40	0.39	U	0.39
4,4'-DDD	PEST	0.53	U	0.53	0.55	U	0.55	0.53	U	0.53	0.52	U	0.52	0.54	U	0.54	0.53	U	0.53
4,4'-DDE	PEST	0.23	U	0.23	0.24	U	0.24	0.23	U	0.23	0.23	U	0.23	0.23	U	0.23	0.23	U	0.23
4,4'-DDT	PEST	0.57	U	0.57	0.59	U	0.59	0.57	U	0.57	0.56	U	0.56	0.58	U	0.58	0.57	U	0.57
Dieldrin	PEST	0.20	U	0.20	0.21	U	0.21	0.20	U	0.20	0.20	U	0.20	0.21	U	0.21	0.20	U	0.20
Endosulfan I	PEST	0.17	U	0.17	0.18	U	0.18	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17
Endosulfan II	PEST	0.28	U	0.28	0.29	U	0.29	0.28	U	0.28	0.27	U	0.27	0.28	U	0.28	0.28	U	0.28
Endosulfan sulfate	PEST	0.27	U	0.27	0.28	U	0.28	0.27	U	0.27	0.26	U	0.26	0.27	U	0.27	0.27	U	0.27
Endrin	PEST	0.30	U	0.30	0.31	U	0.31	0.29	U	0.29	0.29	U	0.29	0.30	U	0.30	0.30	U	0.30
Endrin aldehyde	PEST	0.17	U	0.17	0.17	U	0.17	0.16	U	0.16	0.16	U	0.16	0.17	U	0.17	0.17	U	0.17
Endrin ketone	PEST	0.47	U	0.47	0.49	U	0.49	0.47	U	0.47	0.47	U	0.47	0.48	U	0.48	0.48	U	0.48
Gamma-BHC (Lindane)	PEST	0.45	U	0.45	0.46	U	0.46	0.45	U	0.45	0.44	U	0.44	0.46	U	0.46	0.45	U	0.45
gamma-Chlordane	PEST	0.26	U	0.26	0.27	U	0.27	0.26	U	0.26	0.25	U	0.25	0.26	U	0.26	0.26	U	0.26
Heptachlor	PEST	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.20	U	0.20	0.21	U	0.21	0.21	U	0.21
Heptachlor epoxide	PEST	0.41	U	0.41	0.43	U	0.43	0.41	U	0.41	0.41	U	0.41	0.42	U	0.42	0.41	U	0.41
Methoxychlor	PEST	0.44	U	0.44	0.45	U	0.45	0.43	U	0.43	0.43	U	0.43	0.44	U	0.44	0.44	U	0.44
Toxaphene	PEST	15	U	15	16	U	16	15	U	15	15	U	15	16	U	16	15	U	15

Attachment	1	Sheet No.	12 of 13
Originator	N. K. Schiffern	Date	10/09/12
Checked	J. D. Skoglie	Date	10/09/12
Calc. No.	0100D-CA-V0477	Rev. No.	0

Attachment 1. 100-D-50:9 Subsite Service Area 2 Verification Sampling Results - Organics

CONSTITUENT	CLASS	J1R095, SPA-10			J1R096, SPA-11			J1R097, SPA-12			J1R071, FS-1		
		8/23/2012			8/23/2012			8/23/2012			8/22/2012		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Acenaphthene	PAH	9.2	U	9.2	9.6	U	9.6	9.2	U	9.2	10	U	10
Acenaphthylene	PAH	8.3	U	8.3	8.7	U	8.7	8.3	U	8.3	9.1	U	9.1
Anthracene	PAH	2.8	U	2.8	2.9	U	2.9	2.8	U	2.8	3.1	U	3.1
Benzo(a)anthracene	PAH	2.9	U	2.9	3.1	U	3.1	2.9	U	2.9	3.2	U	3.2
Benzo(a)pyrene	PAH	5.9	U	5.9	6.2	U	6.2	5.9	U	5.9	6.5	U	6.5
Benzo(b)fluoranthene	PAH	3.9	U	3.9	4.0	U	4.0	3.9	U	3.9	4.2	U	4.2
Benzo(ghi)perylene	PAH	6.6	U	6.6	6.9	U	6.9	6.6	U	6.6	7.3	U	7.3
Benzo(k)fluoranthene	PAH	3.6	U	3.6	3.8	U	3.8	3.6	U	3.6	4.0	U	4.0
Chrysene	PAH	4.5	U	4.5	4.7	U	4.7	4.5	U	4.5	4.9	U	4.9
Dibenz[a,h]anthracene	PAH	10	U	10	11	U	11	10	U	10	11	U	11
Fluoranthene	PAH	12	U	12	13	U	13	12	U	12	13	U	13
Fluorene	PAH	4.9	U	4.9	5.1	U	5.1	4.9	U	4.9	5.3	U	5.3
Indeno(1,2,3-cd)pyrene	PAH	11	U	11	12	U	12	11	U	11	12	U	12
Naphthalene	PAH	11	U	11	12	U	12	11	U	11	12	U	12
Phenanthrene	PAH	11	U	11	12	U	12	11	U	11	12	U	12
Pyrene	PAH	11	U	11	12	U	12	11	U	11	12	U	12
Aroclor-1016	PCB	2.7	U	2.7	2.7	U	2.7	2.7	U	2.7	2.8	U	2.8
Aroclor-1221	PCB	7.8	U	7.8	7.8	U	7.8	7.9	U	7.9	8.0	U	8.0
Aroclor-1232	PCB	1.9	U	1.9	1.9	U	1.9	2.0	U	2.0	2.0	U	2.0
Aroclor-1242	PCB	4.5	U	4.5	4.5	U	4.5	4.6	U	4.6	4.7	U	4.7
Aroclor-1248	PCB	4.5	U	4.5	4.5	U	4.5	4.6	U	4.6	4.7	U	4.7
Aroclor-1254	PCB	9.1	JP	2.5	30	P	2.5	2.6	U	2.6	2.6	U	2.6
Aroclor-1260	PCB	14		2.5	27	P	2.5	2.6	U	2.6	2.6	U	2.6
Aldrin	PEST	0.25	U	0.25	0.24	U	0.24	0.25	U	0.25	0.25	U	0.25
Alpha-BHC	PEST	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21
alpha-Chlordane	PEST	0.32	U	0.32	0.31	U	0.31	0.32	U	0.32	0.32	U	0.32
beta-1,2,3,4,5,6-Hexachlorocyclohexane	PEST	0.65	U	0.65	0.64	U	0.64	0.66	U	0.66	0.66	U	0.66
Delta-BHC	PEST	0.39	U	0.39	0.39	U	0.39	0.40	U	0.40	0.40	U	0.40
4,4'-DDD	PEST	0.54	U	0.54	0.53	U	0.53	0.54	U	0.54	0.55	U	0.55
4,4'-DDE	PEST	0.23	U	0.23	0.23	U	0.23	0.24	U	0.24	0.24	U	0.24
4,4'-DDT	PEST	0.58	U	0.58	1.9	X	0.57	0.59	U	0.59	0.59	U	0.59
Dieldrin	PEST	0.21	U	0.21	0.20	U	0.20	0.21	U	0.21	0.21	U	0.21
Endosulfan I	PEST	0.17	U	0.17	0.17	U	0.17	0.18	U	0.18	0.18	U	0.18
Endosulfan II	PEST	0.28	U	0.28	0.28	U	0.28	0.29	U	0.29	0.29	U	0.29
Endosulfan sulfate	PEST	0.27	U	0.27	0.27	U	0.27	0.28	U	0.28	0.28	U	0.28
Endrin	PEST	0.30	U	0.30	0.30	U	0.30	0.31	U	0.31	0.31	U	0.31
Endrin aldehyde	PEST	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17	0.17	U	0.17
Endrin ketone	PEST	0.48	U	0.48	0.47	U	0.47	0.49	U	0.49	0.49	U	0.49
Gamma-BHC (Lindane)	PEST	0.46	U	0.46	0.45	U	0.45	0.46	U	0.46	0.46	U	0.46
gamma-Chlordane	PEST	0.26	U	0.26	0.26	U	0.26	0.27	U	0.27	0.27	U	0.27
Heptachlor	PEST	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21	0.21	U	0.21
Heptachlor epoxide	PEST	0.42	U	0.42	0.41	U	0.41	0.42	U	0.42	0.43	U	0.43
Methoxychlor	PEST	0.44	U	0.44	0.43	U	0.43	0.45	U	0.45	0.45	U	0.45
Toxaphene	PEST	16	U	16	15	U	15	16	U	16	16	UJ	16

Attachment	1	Sheet No.	13 of 13
Originator	N. K. Schiffern	Date	10/09/12
Checked	J. D. Skoglie	Date	10/09/12
Calc. No.	0100D-CA-V0477	Rev. No.	0

Acrobat 8.0

CALCULATION COVER SHEET

Project Title: 100-D Field Remediation **Job No. 14655**

Area: 100-D

Discipline: Environmental *Calculation No: 0100D-CA-V0478

Subject: 100-D-50:9 Subsite Service Area 2 Direct Contact Hazard Quotient and Carcinogenic Risk Calculation

Computer Program: Excel Program No: Excel 2003

The attached calculations have been generated to document compliance with established cleanup levels. These calculations should be used in conjunction with other relevant documents in the administrative record.

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Sheets = 4 Total = 5	N. K. Schiffern N. K. Schiffern	C. H. Dobie C.H. Dobie	J. D. Skoglie	D. F. Obenauer D. F. Obenauer	1/24/13

SUMMARY OF REVISION

WCH-DE-018 (05/08/2007)

*Obtain Calc. No. from Document Control and Form from Intranet

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern	Date:	10/10/12	Calc. No.:	0100D-CA-V0478	Rev.:	0
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	C. H. Dobie	Date:	10/10/12
Subject:	100-D-50:9 Subsite Service Area 2 Direct Contact Hazard Quotient and Carcinogenic Risk Calculation					Sheet No. 1 of 4	

PURPOSE:

Provide documentation to support the calculation of the direct contact hazard quotient (HQ) and excess carcinogenic risk for Service Area 2 in the 100-D-50:9 subsite. In accordance with the remedial action goals (RAGs) in the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2009b), the following criteria must be met:

1) An HQ of <1.0 for all individual noncarcinogens
2) A cumulative HQ of <1.0 for noncarcinogens
3) An excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens
4) A cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.

GIVEN/REFERENCES:

1) DOE-RL, 2009a, *100 Area Remedial Action Sampling and Analysis Plan*, DOE/RL-96-22, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

2) DOE-RL, 2009b, *Remedial Design Report/Remedial Action Work Plan for the 100 Areas*, DOE/RL-96-17, Rev. 6, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

3) WAC 173-340, "Model Toxics Control Act – Cleanup," *Washington Administrative Code*, 1996.

4) WCH, 2012, *100-D-50:9 Subsite Cleanup Verification 95% UCL Calculation*, 0100D-CA-V0477, Rev. 0, Washington Closure Hanford, Inc., Richland, Washington.

SOLUTION:

1) Generate an HQ for each noncarcinogenic constituent detected above background or required detection limit/practical quantitation limit and compare it to the individual HQ of <1.0 (DOE-RL 2009b).

2) Sum the HQs and compare this value to the cumulative HQ of <1.0.

3) Generate an excess cancer risk value for each carcinogenic constituent detected above background or required detection limit/practical quantitation limit and compare it to the excess cancer risk of $<1 \times 10^{-6}$ (DOE-RL 2009b).

4) Sum the excess cancer risk value(s) and compare it to the cumulative cancer risk of $<1 \times 10^{-5}$.

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern	Date:	10/10/12	Calc. No.:	0100D-CA-V0478	Rev.:	0
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	C. H. Dobie	Date:	10/10/12
Subject:	100-D-50:9 Subsite Service Area 2 Direct Contact Hazard Quotient and Carcinogenic Risk Calculation					Sheet No. 2 of 4	

METHODOLOGY:

Service Area 2 in the 100-D-50:9 subsite is comprised of three decision units for verification sampling. Also taken was one focused sample. The direct contact hazard quotient and carcinogenic risk calculations for Service Area 2 in the 100-D-50:9 subsite were conservatively calculated for the entire area using the greater of the statistical or maximum value for each analyte in all decision units from WCH (2012). Of the contaminants of potential concern (COPCs) for this subsite, boron, hexavalent chromium, molybdenum, the detected polcyclic aromatic hydrocarbons (PAHs), the detected polychlorinated biphenyls (PCBs), and 4,4'-DDT require HQ and risk calculations because these analytes were detected and a Washington State or Hanford Site background value is not available. Zinc requires HQ and risk calculations because this analyte was detected above the background value. Lead was detected above background; however, lead does not have a reference dose for calculation of a hazard quotient because toxic effects of lead are correlated with blood-lead levels rather than exposure levels or daily intake. All other site nonradionuclide COPCs were not detected or were quantified below background levels. An example of the HQ and risk calculations is presented below:

1) For example, the statistical value for boron is 1.6 mg/kg, divided by the noncarcinogenic RAG value of 7,200 mg/kg (calculated in accordance with the noncarcinogenic toxics effects formula in WAC 173-340-740[3]), is 2.2×10^{-4}. Comparing this value, and all other individual values, to the requirement of <1.0, this criterion is met.

2) After the HQ calculation is completed for the appropriate analytes, the cumulative HQ can be obtained by summing the individual values. To avoid errors due to intermediate rounding, the individual HQ values prior to rounding are used for this calculation. The sum of the HQ values is 2.6×10^{-2}. Comparing this value to the requirement of <1.0, this criterion is met.

3) To calculate the excess cancer risk, the maximum or statistical value is divided by the carcinogenic RAG value, and then multiplied by 1.0×10^{-6}. For example, the statistical value for hexavalent chromium is 0.693 mg/kg, divided by 2.1 mg/kg, and multiplied as indicated, is 3.3×10^{-7}. Comparing the value for hexavalent chromium, the only carcinogenic RAG, the requirement of $<1 \times 10^{-6}$ is met.

4) After these calculations are completed for the carcinogenic analytes, the cumulative excess cancer risk can be obtained by summing the individual values. To avoid errors due to intermediate rounding, the individual cancer risk values prior to rounding are used for this calculation. The sum of the excess cancer risk values is 7.3×10^{-7}. Comparing this value to the requirement of $<1 \times 10^{-5}$, this criterion is met.

RESULTS:

1) List individual noncarcinogens and corresponding HQs >1.0: None
2) List the cumulative noncarcinogenic HQ >1.0: None
3) List individual carcinogens and corresponding excess cancer risk $>1 \times 10^{-6}$: None
4) List the cumulative excess cancer risk for carcinogens $>1 \times 10^{-5}$: None

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern NKS	Date:	10/10/12	Calc. No.:	0100D-CA-V0478	Rev.:	0
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	C. H. Dobie CHD	Date:	10/10/12
Subject:	100-D-50:9 Subsite Service Area 2 Direct Contact Hazard Quotient and Carcinogenic Risk Calculation					Sheet No. 3 of 4	

Table 1 shows the results of the calculations.

Table 1. Direct Contact Hazard Quotient and Excess Cancer Risk Results for the 100-D-50:9 Subsite Service Area 2.

Contaminant of Potential Concern[a]	Maximum or Statistical Value[a] (mg/kg)	Noncarcinogen RAG[b] (mg/kg)	Hazard Quotient	Carcinogen RAG[b] (mg/kg)	Carcinogen Risk
Metals					
Boron	1.6	7,200	2.2E-04	--	--
Chromium, hexavalent[c]	0.693	240	2.9E-03	2.1	3.3E-07
Lead[d]	16.0	353		--	--
Molybdenum	0.32	400	8.0E-04	--	--
Zinc	68.2	24,000	2.8E-03	--	--
Polycyclic Aromatic Hydrocarbons					
Benzo(a)anthracene	0.015	--	--	1.37	1.1E-08
Benzo(a)pyrene	0.024	--	--	0.137	1.8E-07
Benzo(b)fluoranthene	0.066	--	--	1.37	4.8E-08
Benzo(ghi)perylene[e]	0.040	2,400	1.7E-05		--
Benzo(k)fluoranthene	0.019	--	--	1.37	1.4E-08
Chrysene	0.068	--	--	13.7	5.0E-09
Fluoranthene	0.024	3,200	7.5E-06	--	--
Indeno(1,2,3-cd) pyrene	0.039	--	--	1.37	2.8E-08
Phenanthrene[e]	0.026	24,000	1.1E-06	--	--
Pyrene	0.030	2,400	1.3E-05	--	--
Polychlorinated Biphenyls					
Aroclor-1254	0.030	1.6	1.9E-02	0.5	6.0E-08
Aroclor-1260	0.027	--	--	0.5	5.4E-08
Pesticides					
DDT; 4,4'-	0.0019	40	4.8E-05	2.94	6.5E-10
Totals					
Cumulative Hazard Quotient:			**2.6E-02**		
Cumulative Excess Cancer Risk:					**7.3E-07**

Note:

[a] = From WCH (2012).

[b] = Value obtained from the RDR/RAWP (DOE-RL 2009b) or *Washington Administrative Code* (WAC) 173-340-740(3), Method B, 1996, unless otherwise noted.

[c] = Carcinogenic cleanup level calculated based on the inhalation exposure pathway; WAC 173-340-750(3), 1996.

[d] = Value for the noncarcinogenic RAG calculated using Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children, EPA/540/R 93/081, Publication No. 9285.7, U.S. Environmental Protection Agency, Washington, D.C.

[e] =Toxicity data for benzo(ghi)perylene, and phenanthrene are not available. The cleanup level is based on use of surrogate chemicals.
benzo(ghi)perylene surrogate: pyrene;
phenanthrene surrogate: anthracene.

-- = not applicable

RAG = remedial action goal

CONCLUSION:

The calculations in Table 1 demonstrate that Service Area 2 in the 100-D-50:9 subsite meets the requirements for the direct contact hazard quotients and carcinogenic (excess cancer) risk, respectively,

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern	Date:	10/10/12	Calc. No.:	0100D-CA-V0478	Rev.:	0
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	C. H. Dobie	Date:	10/10/12
Subject:	100-D-50:9 Subsite Service Area 2 Direct Contact Hazard Quotient and Carcinogenic Risk Calculation					Sheet No.	4 of 4

as identified in the RDR/RAWP (DOE-RL 2009b) and SAP (DOE-RL 2009a). The direct contact hazard quotients and carcinogenic (excess cancer) risk calculations are for use in the RSVP for this site.

Acrobat 8.0

CALCULATION COVER SHEET

Project Title: 100-D Field Remediation **Job No. 14655**

Area: 100-D

Discipline: Environmental Calculation No: 0100D-CA-V0486

Subject: 100-D-50:9 Subsite Service Area 2 Hazard Quotient and Carcinogenic Risk Calculations for Protection of Groundwater

Computer Program: Excel Program No: Excel 2003

The attached calculations have been generated to document compliance with established cleanup levels. These calculations should be used in conjunction with other relevant documents in the administrative record.

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Summary = 3 Total = 4	N. K. Schiffern N. K. Schiffern	C. H. Dobie CH Dobie	J. D. Skoglie [signature]	D. F. Obenauer D. F. Obenauer	1/24/13

SUMMARY OF REVISION

WCH-DE-018 (05/08/2007)

DE01-437.03

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern	Date:	10/10/2012	Calc. No.:	0100D-CA-V0486	Rev.:	0
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	C. H. Dobie	Date:	10/10/2012
Subject:	100-D-50:9 Subsite Service Area 2 Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater					Sheet No. 1 of 3	

PURPOSE:

Provide documentation to support the calculation of the hazard quotient (HQ) and excess carcinogenic risk associated with soil contaminant levels compared to soil cleanup levels for protection of groundwater for Service Area 2 in the 100-D-50:9 subsite. In accordance with the remedial action goals (RAGs) in the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2009), the following criteria must be met:

1) An HQ of <1.0 for all individual noncarcinogens
2) A cumulative HQ of <1.0 for noncarcinogens
3) An excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens
4) A cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.

GIVEN/REFERENCES:

1) BHI, 2005, *100 Area Analogous Sites RESRAD Evaluation*, Calculation No. 0100X-CA-V0050 Rev 0, Bechtel Hanford, Inc., Richland, Washington.

2) DOE-RL, 2009, *Remedial Design Report/Remedial Action Work Plan for the 100 Areas*, DOE/RL-96-17, Rev. 6, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

3) WAC 173-340, "Model Toxics Control Act – Cleanup," *Washington Administrative Code*, 1996.

4) WCH, 2012, *100-D-50:9 Subsite Service Area 2 Cleanup Verification 95% UCL Calculations*, 0100D-CA-V0477, Rev. 0, Washington Closure Hanford, Inc., Richland, Washington.

SOLUTION:

1) Generate a HQ for each noncarcinogenic constituent detected above background in soil and with a K_d less than that required to show no migration to groundwater in 1,000 years using the RESRAD generic site model (BHI 2005).

2) Sum the HQs and compare this value to the cumulative HQ of <1.0.

3) Generate an excess cancer risk value for each carcinogenic constituent detected above background in soil and with a K_d less than that required to show no migration to groundwater in 1,000 years using the RESRAD generic site model (BHI 2005).

4) Sum the excess cancer risk value(s) and compare it to the cumulative cancer risk of $<1 \times 10^{-5}$.

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern	Date:	10/10/2012	Calc. No.:	0100D-CA-V0486	Rev.:	0
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	C. H. Dobie	Date:	10/10/2012
Subject:	100-D-50:9 Subsite Service Area 2 Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater					Sheet No. 2 of 3	

METHODOLOGY:

Service Area 2 in the 100-D-50:9 subsite was divided into three decision units for the purpose of verification sampling; excavation, overburden, and staging pile area. Also taken was one focused sample. Hazard quotient and carcinogenic risk calculations for potential impact to groundwater at Service Area 2 in the 100-D-50:9 subsite were conservatively calculated for the entire area using the greater of the statistical or maximum value for each analyte in all decision units from the 95% UCL calculation (WCH 2012). Of the contaminants of potential concern (COPCs) for this site, boron and hexavalent chromium are included because no Washington State or Hanford background value has been established and the distribution coefficients are less than that necessary to show no migration to groundwater in 1,000 years using the generic site RESRAD model (BHI 2005). Based on this model and a vadose zone of approximately 20.8 m (68.2 ft) thickness, a K_d of 3.7 or greater is required to show no predicted migration to groundwater in 1,000 years. All other site nonradionuclide COPCs were not detected, quantified below background levels, or have a K_d greater than or equal to 3.7. An example of the HQ and risk calculations for soil constituents with a potential impact to groundwater is presented below:

1) The hazard quotient is defined as the ratio of the dose of a substance obtained over a specified time (mg/kg/day) to a reference dose for the same substance derived over the same specified time (mg/kg/day). The hazard quotient can also be calculated as the ratio of the concentration in soil (maximum or statistical value) (mg/kg) to the soil RAG (mg/kg) for protection of groundwater, where the RAG is the groundwater cleanup level (mg/L) (calculated with, and related to the hazard quotient through, WAC 173-340-720(3)(a)(ii)(A), 1996) x 100 x 1 mg/1000 mg (conversion factor). This is based on the "100 times rule" of WAC 173-340-740(3)(a)(ii)(A) (1996). For example, the maximum value for boron of 1.6 mg/kg, divided by the noncarcinogenic RAG value of 320 mg/kg is 5.0×10^{-3}. Comparing this value to the requirement of <1.0, this criterion is met.

2) After the HQ calculation is completed for the appropriate analytes, the cumulative HQ can be obtained by summing the individual values. (To avoid errors due to intermediate rounding, the individual HQ values prior to rounding are used for this calculation.) The cumulative HQ for Service Area 2 in the 100-D-50:9 subsite is 1.5×10^{-1}. Comparing this value to the requirement of <1.0, this criterion is met.

3) To calculate the excess cancer risk, the maximum or statistical value is divided by the carcinogenic RAG value, and then multiplied by 1×10^{-6}. Service Area 2 in the 100-D-50:9 subsite doesn't have any constituents with carcinogen RAG, therefore, the criterion for excess cancer risk is met. Consequently, the criterion for cumulative excess cancer risk for carcinogens is also met.

4) The soil cleanup RAGs for protection of groundwater are based on the "100 times" provision in WAC 173-340-740(3)(a)(ii)(A). WAC 173-340-740(3)(a)(ii)(A) (1996) provides the "100 times rule" but also states "unless it can be demonstrated that a higher soil concentration is protective of ground water at the site." When the "100 times rule" values are exceeded, RESRAD was used to demonstrate that higher soil concentrations may be protective of groundwater.

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern	Date:	10/10/2012	Calc. No.:	0100D-CA-V0486	Rev.:	0
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	C. H. Dobie	Date:	10/10/2012
Subject:	100-D-50:9 Subsite Service Area 2 Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater					Sheet No. 3 of 3	

RESULTS:

1) List individual noncarcinogens and corresponding HQs >1.0: None
2) List the cumulative noncarcinogenic HQ >1.0: None
3) List individual carcinogens and corresponding excess cancer risk >1 x 10^{-6}: None
4) List the cumulative excess cancer risk for carcinogens >1 x 10^{-5}: None.

Table 1 shows the results of the calculations.

Table 1. Hazard Quotient and Excess Cancer Risk Results for Service Area 2 in the 100-D-50:9 Subsite.

Contaminants of Potential Concern[a]	Maximum or Statistical Value[a] (mg/kg)	Noncarcinogen RAG[b] (mg/kg)	Hazard Quotient	Carcinogen RAG[b] (mg/kg)	Carcinogen Risk
Metals					
Boron	1.6	320	5.0E-03	--	--
Chromium, hexavalent	0.693	4.8	1.4E-01	--	--
Totals					
Cumulative Hazard Quotient:			**1.5E-01**		
Cumulative Excess Cancer Risk:					**0.0E+00**

Notes:
[a] = From WCH (2012).
[b] = Value obtained from the Cleanup Levels and Risk Calculations (CLARC) database using Groundwater, Method B, results and the "100 times" model.
-- = not applicable
RAG = remedial action goal

CONCLUSION:

This calculation demonstrates that Service Area 2 in the 100-D-50:9 subsite meets the requirements for the hazard quotients and excess carcinogenic risk for protection of groundwater as identified in the RDR/RAWP (DOE-RL 2009).

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CALCULATION COVER SHEET

Project Title: 100-D Field Remediation **Job No. 14655**

Area: 100-D

Discipline: Environmental Calculation No: 0100D-CA-V0487

Subject: 100-D-50:9 Subsite Service Area 1 Hazard Quotient and Carcinogenic Risk Calculations for Protection of Groundwater

Computer Program: Excel Program No: Excel 2003

The attached calculations have been generated to document compliance with established cleanup levels. These calculations should be used in conjunction with other relevant documents in the administrative record.

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Summary = 3 Total = 4	N. K. Schiffern N. K. Schiffern	C. H. Dobie C H Dobie	J. D. Skoglie J D Skoglie	D. F. Obenauer D. F. Obenauer	1/24/13

SUMMARY OF REVISION

WCH-DE-018 (05/08/2007)

DE01-437.03

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern	Date:	10/18/2012	Calc. No.:	0100D-CA-V0487	Rev.:	0
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	C. H. Dobie	Date:	10/18/2012
Subject:	100-D-50:9 Subsite Service Area 1 Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater					Sheet No. 1 of 3	

PURPOSE:

Provide documentation to support the calculation of the hazard quotient (HQ) and excess carcinogenic risk associated with soil contaminant levels compared to soil cleanup levels for protection of groundwater for Service Area 1 in the 100-D-50:9 subsite. In accordance with the remedial action goals (RAGs) in the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2009), the following criteria must be met:

1) An HQ of <1.0 for all individual noncarcinogens
2) A cumulative HQ of <1.0 for noncarcinogens
3) An excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens
4) A cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.

GIVEN/REFERENCES:

1) BHI, 2005, *100 Area Analogous Sites RESRAD Evaluation*, Calculation No. 0100X-CA-V0050 Rev 0, Bechtel Hanford, Inc., Richland, Washington.

2) DOE-RL, 2009, *Remedial Design Report/Remedial Action Work Plan for the 100 Areas,* DOE/RL-96-17, Rev. 6, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

3) WAC 173-340, "Model Toxics Control Act – Cleanup," *Washington Administrative Code*, 1996.

4) WCH, 2012, *100-D-50:9 Subsite Service Area 1 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations*, 0100D-CA-V0488, Rev. 0, Washington Closure Hanford, Inc., Richland, Washington.

SOLUTION:

1) Generate a HQ for each noncarcinogenic constituent detected above background in soil and with a K_d less than that required to show no migration to groundwater in 1,000 years using the RESRAD generic site model (BHI 2005).

2) Sum the HQs and compare this value to the cumulative HQ of <1.0.

3) Generate an excess cancer risk value for each carcinogenic constituent detected above background in soil and with a K_d less than that required to show no migration to groundwater in 1,000 years using the RESRAD generic site model (BHI 2005).

4) Sum the excess cancer risk value(s) and compare it to the cumulative cancer risk of $<1 \times 10^{-5}$.

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern NS	Date:	10/18/2012	Calc. No.:	0100D-CA-V0487	Rev.:	0
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	C. H. Dobie CD	Date:	10/18/2012
Subject:	100-D-50:9 Subsite Service Area 1 Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater					Sheet No. 2 of 3	

METHODOLOGY:

Service Area 1 in the 100-D-50:9 subsite underwent focused sampling at two test pit locations: Test Pit 1 and Test Pit 4. Both pipe sediment and underlying soil were sampled at the Test Pit 1, and only soil was sampled at the Test Pit 4. Also taken were a duplicate sample and equipment blank. A total of five focused samples and one duplicate sample were collected at Service Area 1 in the 100-D-50:9 subsite. Hazard quotient and carcinogenic risk calculations for potential impact to groundwater at Service Area 1 in the 100-D-50:9 subsite were conservatively calculated for the entire area using the maximum soil value for each analyte from the RPD and Direct Contact Hazard Quotient and Carcinogenic Risk Calculation (WCH 2012). Of the contaminants of potential concern (COPCs) for this site, boron and hexavalent chromium are included because no Washington State or Hanford background value has been established and the distribution coefficients are less than that necessary to show no migration to groundwater in 1,000 years using the generic site RESRAD model (BHI 2005). Based on this model and a vadose zone of approximately 20.8 m (68.2 ft) thickness, a K_d of 3.7 or greater is required to show no predicted migration to groundwater in 1,000 years. All other site nonradionuclide COPCs were not detected, quantified below background levels, or have a K_d greater than or equal to 3.7. An example of the HQ and risk calculations for soil constituents with a potential impact to groundwater is presented below:

1) The hazard quotient is defined as the ratio of the dose of a substance obtained over a specified time (mg/kg/day) to a reference dose for the same substance derived over the same specified time (mg/kg/day). The hazard quotient can also be calculated as the ratio of the concentration in soil (maximum or statistical value) (mg/kg) to the soil RAG (mg/kg) for protection of groundwater, where the RAG is the groundwater cleanup level (mg/L) (calculated with, and related to the hazard quotient through, WAC 173-340-720(3)(a)(ii)(A), 1996) x 100 x 1 mg/1000 mg (conversion factor). This is based on the "100 times rule" of WAC 173-340-740(3)(a)(ii)(A) (1996). For example, the maximum value for boron of 1.5 mg/kg, divided by the noncarcinogenic RAG value of 320 mg/kg is 4.7×10^{-3}. Comparing this value to the requirement of <1.0, this criterion is met.

2) After the HQ calculation is completed for the appropriate analytes, the cumulative HQ can be obtained by summing the individual values. (To avoid errors due to intermediate rounding, the individual HQ values prior to rounding are used for this calculation.) The cumulative HQ for Service Area 1 in the 100-D-50:9 subsite is 6.3×10^{-2}. Comparing this value to the requirement of <1.0, this criterion is met.

3) To calculate the excess cancer risk, the maximum or statistical value is divided by the carcinogenic RAG value, and then multiplied by 1×10^{-6}. Service Area 1 in the 100-D-50:9 subsite doesn't have any constituents with carcinogen RAG, the criterion for excess cancer risk is met. Consequently, the criterion for cumulative excess cancer risk for carcinogens is also met.

4) The soil cleanup RAGs for protection of groundwater are based on the "100 times" provision in WAC 173-340-740(3)(a)(ii)(A). WAC 173-340-740(3)(a)(ii)(A) (1996) provides the "100 times rule" but also states "unless it can be demonstrated that a higher soil concentration is protective of ground water at the site." When the "100 times rule" values are exceeded, RESRAD was used to demonstrate that higher soil concentrations may be protective of groundwater.

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern	Date:	10/18/2012	Calc. No.:	0100D-CA-V0487	Rev.:	0
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	C. H. Dobie	Date:	10/18/2012
Subject:	100-D-50:9 Subsite Service Area 1 Hazard Quotient and Carcinogenic Risk Calculation for Protection of Groundwater					Sheet No. 3 of 3	

RESULTS:

1) List individual noncarcinogens and corresponding HQs >1.0: None
2) List the cumulative noncarcinogenic HQ >1.0: None
3) List individual carcinogens and corresponding excess cancer risk >1 x 10^{-6}: None
4) List the cumulative excess cancer risk for carcinogens >1 x 10^{-5}: None.

Table 1 shows the results of the calculations.

Table 1. Hazard Quotient and Excess Cancer Risk Results for Service Area 1 in the 100-D-50:9 Subsite.

Contaminants of Potential Concern[a]	Maximum or Statistical Value[a] (mg/kg)	Noncarcinogen RAG[b] (mg/kg)	Hazard Quotient	Carcinogen RAG[b] (mg/kg)	Carcinogen Risk
Metals					
Boron	1.5	320	4.7E-03	--	--
Chromium, hexavalent	0.28	4.8	5.8E-02	--	--
Totals					
Cumulative Hazard Quotient:			**6.3E-02**		
Cumulative Excess Cancer Risk:					**0.0E+00**

Notes:
[a] = From WCH (2012).
[b] = Value obtained from the Cleanup Levels and Risk Calculations (CLARC) database using Groundwater, Method B, results and the "100 times" model.
-- = not applicable
RAG = remedial action goal

CONCLUSION:

This calculation demonstrates that Service Area 1 in the 100-D-50:9 subsite meets the requirements for the hazard quotients and excess carcinogenic risk for protection of groundwater as identified in the RDR/RAWP (DOE-RL 2009).

Acrobat 8.0

CALCULATION COVER SHEET

Project Title: 100-D Area Field Remediation **Job No. 14655**

Area: 100-D

Discipline: Environmental Calculation No: 0100D-CA-V0488

Subject: 100-D-50:9 Subsite Service Area 1 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations

Computer Program: Excel Program No: Excel 2003

The attached calculations have been generated to document compliance with established cleanup levels. These calculations should be used in conjunction with other relevant documents in the administrative record.

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Summary = 5 Attachment 1 = 10 Total = 16	N. K. Schiffern N.K. Schiffern	C. H. Dobie C.H. Dobie	J. D. Skoglie [signature]	D. F. Obenauer D. F. Obenauer	1/24/13

SUMMARY OF REVISION

WCH-DE-018 (05/08/2007)

DE01-437.03

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern *NS*	Date:	10/18/2012	Calc. No.:	0100D-CA-V0488	Rev.:	0
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	C. H. Dobie *CD*	Date:	10/18/2012
Subject:	100-D-50:9 Subsite Service Area 1 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 1 of 5	

PURPOSE:

Provide documentation to support the calculation of the direct contact hazard quotient (HQ) and excess carcinogenic risk for Service Area 1 in the 100-D-50:9 subsite. In accordance with the remedial action goals (RAGs) in the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2009b), the following criteria must be met:

1) An HQ of <1.0 for all individual noncarcinogens
2) A cumulative HQ of <1.0 for noncarcinogens
3) An excess cancer risk of <1 x 10^{-6} for individual carcinogens
4) A cumulative excess cancer risk of <1 x 10^{-5} for carcinogens.

Also, calculate the relative percent difference (RPD) for primary-duplicate sample pairs from Service Area 1 in the 100-D-50:9 subsite confirmatory sampling, as necessary.

GIVEN/REFERENCES:

1) DOE-RL, 2009a, *100 Area Remedial Action Sampling and Analysis Plan,* DOE/RL-96-22, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

2) DOE-RL, 2009b, *Remedial Design Report/Remedial Action Work Plan for the 100 Area,* DOE/RL-96-17, Rev. 6, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

3) EPA, 1994, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, EPA 540/R-94/013, U.S. Environmental Protection Agency, Washington, D.C.

4) WAC 173-340, "Model Toxics Control Act – Cleanup," *Washington Administrative Code*, 1996.

5) WCH, 2012, *Remaining Sites Verification Package for the 100-D-50:9, 1607-DR3 Sanitary Sewer Pipeline*, Attachment to Waste Site Reclassification Form 2012-094, Washington Closure Hanford, Inc., Richland, Washington.

SOLUTION:

1) Generate an HQ for each noncarcinogenic constituent detected above background or required detection limit/practical quantitation limit and compare it to the individual HQ of <1.0 (DOE-RL 2009b).

2) Sum the HQs and compare this value to the cumulative HQ of <1.0.

3) Generate an excess cancer risk value for each carcinogenic constituent detected above background or required detection limit/practical quantitation limit and compare it to the excess cancer risk of <1 x 10^{-6} (DOE-RL 2009b).

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern NS	Date:	10/18/2012	Calc. No.:	0100D-CA-V0488	Rev.:	0
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	C. H. Dobie CD	Date:	10/18/2012
Subject:	100-D-50:9 Subsite Service Area 1 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 2 of 5	

4) Sum the excess cancer risk value(s) and compare it to the cumulative cancer risk of <1 x 10^{-5}.

5) Use data from WCH (2012) to perform the RPD calculations for primary-duplicate sample pairs, as required.

METHODOLOGY:

Service Area 1 in the 100-D-50:9 subsite underwent focused sampling at two test pit locations: Test Pit 1 and Test Pit 4. Both pipe sediment and underlying soil were sampled at the Test Pit 1, and only soil was sampled at the Test Pit 4. Also taken were a duplicate sample and equipment blank. A total of five focused samples and one duplicate sample were collected at Service Area 1 in the 100-D-50:9 subsite. The direct contact hazard quotient and carcinogenic risk calculations for the 100-D-50:9 Service Area 1 were conservatively calculated using the greatest of the maximum soil sample results (WCH 2012). Of the contaminants of potential concern (COPCs) for this subsite, boron, hexavalent chromium, molybdenum, and bis(2-ethylhexyl)phthalate require HQ and risk calculations because these analytes were detected and a Washington State or Hanford Site background value is not available. Although total petroleum hydrocarbons (diesel range extended) were detected and no background value is available, the risk associated with total petroleum hydrocarbons do not contribute to the cumulative toxicity calculation. All other site nonradionuclide COPCs were not detected or were quantified below background levels. An example of the HQ and risk calculations is presented below:

1) For example, the maximum value for boron is 1.5 mg/kg, divided by the noncarcinogenic RAG value of 7,200 mg/kg (calculated in accordance with the noncarcinogenic toxics effects formula in WAC 173-340-740[3]), is 2.1 x 10^{-4}. Comparing this value, and all other individual values, to the requirement of <1.0, this criterion is met.

2) After the HQ calculation is completed for the appropriate analytes, the cumulative HQ can be obtained by summing the individual values. To avoid errors due to intermediate rounding, the individual HQ values prior to rounding are used for this calculation. The sum of the HQ values is 2.5 x 10^{-3}. Comparing this value to the requirement of <1.0, this criterion is met.

3) To calculate the excess cancer risk, the maximum or statistical value is divided by the carcinogenic RAG value, and then multiplied by 1.0 x 10^{-6}. For example, the maximum value for hexavalent chromium is 0.28 mg/kg, divided by 2.1 mg/kg, and multiplied as indicated, produces the value of 1.3 x 10^{-7}. Comparing the value for hexavalent chromium, the only carcinogenic RAG, the requirement of <1 x 10^{-6} is met.

4) After these calculations are completed for the carcinogenic analytes, the cumulative excess cancer risk can be obtained by summing the individual values. To avoid errors due to intermediate rounding, the individual cancer risk values prior to rounding are used for this calculation. The sum of the excess cancer risk values is 1.4 x 10^{-7}. Comparing these values to the requirement of <1 x 10^{-5}, this criterion is met.

5) The RPD is calculated when both the primary value and the duplicate value for a given analyte are above detection limits and are greater than 5 times the target detection limit (TDL). The TDL is a laboratory detection limit pre-determined for each analytical method and is listed for certain analytes

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern NS	Date:	10/18/2012	Calc. No.:	0100D-CA-V0488	Rev.:	0
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	C. H. Dobie CD	Date:	10/18/2012
Subject:	100-D-50:9 Subsite Service Area 1 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 3 of 5	

in Table II-1 of the SAP (DOE-RL 2009a). Other analytes will have their own pre-determined constituents and will have their own TDLs based on the laboratory and method used. Where direct evaluation of the attached sample data showed that a given analyte was not detected in the primary and/or duplicate sample, further evaluation of the RPD value was not performed. The RPD calculations use the following formula:

$$RPD = [\ |M-D|/((M+D)/2)]*100$$

where, M = main sample value D = duplicate sample value

When an analyte is detected in the primary or duplicate sample, but was quantified at less than 5 times the TDL in one or both samples, an additional parameter is evaluated. In this case, if the difference between the primary and duplicate results exceeds a control limit of 2 times the TDL, further assessment regarding the usability of the data is performed. This assessment is provided in the data quality assessment section of the RSVP.

For quality assurance/quality control (QA/QC) duplicate RPD calculations, a value less than 30% indicates the data compare favorably. For regulatory splits, a threshold of 35% is used (EPA 1994). If the RPD is greater than 30% (or 35% for regulatory split data), further investigation regarding the usability of the data is performed. No split samples were collected for the confirmatory sampling of the subject site. Additional discussion is provided in the data quality assessment section of the applicable RSVP (WCH 2012), as necessary.

RESULTS:

1) List individual noncarcinogens and corresponding HQs >1.0: None
2) List the cumulative noncarcinogenic HQ >1.0: None
3) List individual carcinogens and corresponding excess cancer risk >1 x 10^{-6}: None
4) List the cumulative excess cancer risk for carcinogens >1 x 10^{-5}: None

Table 1 shows the results of the hazard quotient and excess cancer risk calculations.

5) The evaluation of the QA/QC duplicate RPD calculations are performed within the data quality assessment section of the RSVP.

Table 2 shows the results of the RPD calculations for Service Area 1 in the 100-D-50:9 subsite.

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern	Date:	10/18/2012	Calc. No.:	0100D-CA-V0488	Rev.:	0
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	C. H. Dobie	Date:	10/18/2012
Subject:	100-D-50:9 Subsite Service Area 1 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 4 of 5	

Table 1. Direct Contact Hazard Quotient and Excess Cancer Risk Results for Service Area 1 in the 100-D-50:9 Subsite.

Contaminant of Potential Concern[a]	Maximum or Statistical Value[a] (mg/kg)	Noncarcinogen RAG[b] (mg/kg)	Hazard Quotient	Carcinogen RAG[b] (mg/kg)	Carcinogen Risk
Metals					
Boron	1.5	7,200	2.1E-04	--	--
Chromium, hexavalent[c]	0.28	240	1.2E-03	2.1	1.3E-07
Molybdenum	0.42	400	1.1E-03	--	--
Semivolatiles					
Bis(2-ethylhexyl)phthalate	0.19	1,600	1.2E-04	71.4	2.7E-09
Total Petroleum Hydrocarbon					
TPH-diesel range extended[d]	8.3	200	--	--	--
Totals					
Cumulative Hazard Quotient:			**2.5E-03**		
Cumulative Excess Cancer Risk:					**1.4E-07**

Note:

[a] = From WCH (2012).

[b] = Value obtained from the RDR/RAWP (DOE-RL 2009b) or *Washington Administrative Code* (WAC) 173-340-740(3), Method B, 1996, unless otherwise noted.

[c] = Carcinogenic cleanup level calculated based on the inhalation exposure pathway; WAC 173-340-750(3), 1996.

[d] =The risk associated with total petroleum hydrocarbons do not contribute to the cumulative toxicity calculation.

-- = not applicable

RAG = remedial action goal

Table 2. Relative Percent Difference Calculations for Service Area 1 in the 100-D-50:9 Subsite. (2 pages)

100-D-50:9 Subsite Service Area 1 Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Gross beta			Aluminum			Arsenic			Barium			Beryllium		
			pCi/g	Q	MDA	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
TP4, Service Area 1 (Soil)	J1NPD9	4/11/12	21.7		2.26	6450		1.7	3.4		0.71	60.2		0.081	0.60		0.035
Duplicate of J1NPD9	J1NPF0	4/11/12	21.3		2.20	6240		1.7	3.4		0.71	58.0		0.081	0.60		0.035

Analysis:

TDL		15	5	10	2	0.2
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	No-Stop (acceptable)
	RPD		3.3%		3.7%	
	Difference > 2 TDL?	No - acceptable	Not applicable	No - acceptable	Not applicable	No - acceptable

100-D-50:9 Subsite Service Area 1 Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Cadmium			Calcium			Chromium			Cobalt			Copper		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
TP4, Service Area 1 (Soil)	J1NPD9	4/11/12	0.12	B	0.044	4600		15.1	7.6		0.062	8.0	X	0.11	15.2		0.23
Duplicate of J1NPD9	J1NPF0	4/11/12	0.07	B	0.044	4760		15.1	8.1		0.062	8.1	X	0.11	16.2		0.23

Analysis:

TDL		0.2	100	1	2	1
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)
	RPD		3.4%	6.4%		6.4%
	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	No - acceptable	Not applicable

Washington Closure Hanford, Inc. CALCULATION SHEET

Originator:	N. K. Schiffern NKS	Date:	10/18/2012	Calc. No.:	0100D-CA-V0488	Rev.:	0
Project:	100-D Area Field Remediation	Job No:	14655	Checked:	C. H. Dobie CD	Date:	10/18/2012
Subject:	100-D-50:9 Subsite Service Area 1 Relative Percent Difference (RPD) and Direct Contact Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 5 of 5	

Table 2. Relative Percent Difference Calculations for Service Area 1 in the 100-D-50:9 Subsite. (2 pages)

100-D-50:9 Subsite Service Area 1 Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Iron			Lead			Magnesium			Manganese			Nickel		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
TP4, Service Area 1 (Soil)	J1NPD9	4/11/12	21700		4.1	3.6		0.29	4390		4.0	337		0.11	10.2	M	0.13
Duplicate of J1NPD9	J1NPF0	4/11/12	22200		4.1	3.4		0.29	4490		4.0	332		0.11	11.3		0.13

Analysis:

		Iron	Lead	Magnesium	Manganese	Nickel
TDL		5	5	75	5	4
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)
	RPD	2.3%		2.3%	1.5%	
	Difference > 2 TDL?	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable

100-D-50:9 Subsite Service Area 1 Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Potassium			Silicon			Sodium			Uranium			Vanadium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
TP4, Service Area 1 (Soil)	J1NPD9	4/11/12	952		43.9	214		6.1	253		63.2	0.361		0.333	51.1		0.10
Duplicate of J1NPD9	J1NPF0	4/11/12	807		43.9	267		6.1	267		63.2	0.362		0.330	54.3		0.10

Analysis:

		Potassium	Silicon	Sodium	Uranium	Vanadium
TDL		400	2	50	1	2.5
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No-Stop (acceptable)	Yes (calc RPD)	Yes (calc RPD)	No-Stop (acceptable)	Yes (calc RPD)
	RPD		22.0%	5.4%		6.1%
	Difference > 2 TDL?	No - acceptable	Not applicable	Not applicable	No - acceptable	Not applicable

100-D-50:9 Subsite Service Area 1 Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Zinc			TPH - Diesel			TPH - Diesel EXT		
			mg/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
TP4, Service Area 1 (Soil)	J1NPD9	4/11/12	55.7	X	0.43	3900	J	720	8300		1100
Duplicate of J1NPD9	J1NPF0	4/11/12	49.7	X	0.43	2900	J	700	6600		1000

Analysis:

		Zinc	TPH - Diesel	TPH - Diesel EXT
TDL		1	5000	5000
Duplicate Analysis	Both > PQL?	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No-Stop (acceptable)	No-Stop (acceptable)
	RPD	11.4%		
	Difference > 2 TDL?	Not applicable	No - acceptable	No - acceptable

CONCLUSION:

The calculations in Tables 1 and 2 demonstrate that Service Area 1 in the 100-D-50:9 subsite meets the requirements for the hazard quotients and carcinogenic (excess cancer) risk and RPDs, respectively, as identified in the RDR/RAWP (DOE-RL 2009b) and SAP (DOE-RL 2009a). The hazard quotients and carcinogenic (excess cancer) risk and RPD calculations are for use in the RSVP for this site.

Attachment 1. 100-D-50:9 Subsite Service Area 1 Confirmatory Sample Results (Radionuclides).

Sample Location	HEIS Number	Sample Date	Americium-241 GEA			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
TP4, Service Area 1 (Soil)	J1NPD9	4/11/12	0.0129	U	0.0978	-0.00906	U	0.0312	0.00963	U	0.0323	-0.0386	U	0.0775	0.00556	U	0.107	0.0184	U	0.0781
Duplicate of J1NPD9	J1NPF0	4/11/12	-0.0296	U	0.0594	-0.00116	U	0.0330	0.0000173	U	0.0359	-0.0279	U	0.0901	0.0232	U	0.109	0.0201	U	0.0890
TP1, Service Area 1 (Sediment)	J10FJ2	11/5/05	0.27	U	0.27	0.638		0.10	0.094	U	0.094	0.19	U	0.19	0.25	U	0.25	0.20	U	0.20
TP1, Service Area 1 (Soil)	J10FH6	11/5/05	0.16	U	0.16	0.029	U	0.029	0.034	U	0.034	0.10	U	0.10	0.11	U	0.11	0.11	U	0.11

Sample Location	HEIS Number	Sample Date	Gross alpha			Gross beta			Potassium-40			Radium-226			Radium-228			Thorium-228 GEA		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
TP4, Service Area 1 (Soil)	J1NPD9	4/11/12	2.63	U	6.66	21.7		2.26												
Duplicate of J1NPD9	J1NPF0	4/11/12	5.47	U	7.16	21.3		2.20												
TP1, Service Area 1 (Sediment)	J10FJ2	11/5/05	7.22		3.7	15.2		5.9	9.54		0.73	0.369		0.14	0.65	U	0.65	0.638	J	0.14
TP1, Service Area 1 (Soil)	J10FH6	11/5/05	7.42		3.3	20.5		5.4	9.48		0.31	0.483		0.057	0.742		0.13	0.853		0.053

Sample Location	HEIS Number	Sample Date	Thorium-232 GEA			Uranium-235 GEA			Uranium-238 GEA		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
TP1, Service Area 1 (Sediment)	J10FJ2	11/5/05	0.65	U	0.65	0.28	U	0.28	9.8	U	9.8
TP1, Service Area 1 (Soil)	J10FH6	11/5/05	0.742		0.13	0.16	U	0.16	3.7	U	3.7

Acronyms and notes apply to all of the tables in this attachment.

Gray cells indicate not applicable.

Service Area 2 underwent remedial action, therefore the data are provided for informational purposes use only.

Herbicide and TPH analyses in the sample J10FJ2 were mistakenly analyzed, however the data are added into the calculation.

Note: Data qualified with B, C, and/or J are considered acceptable values.

B = detected but below the reporting limitm result is an estimated concentration.
C = detected both in sample and QC blank.
D = result reported from a dilution
I = interference
HERB = herbicides
HEIS=Hanford Environmental Information System
J = estimated
PCB = polycyclic aromatic hydrocarbons
PEST = pesticides
PQL = practical quantitation limit
Q = qualifier
QC = quality control.
SVOA = semivolatile organic analysis
TPH = total petroleum hydrocarbon
U = analyzed for and not detected.

Attachment	1	Sheet No.	1 of 10
Originator	N. K. Schiffern NS	Date	10/10/12
Checked	C. H. Dobie CD	Date	10/10/12
Calc. No.	0100D-CA-V0488	Rev. No.	0

Attachment 1. 100-D-50:9 Subsite Service Area 1 Confirmatory Sample Results (Metals, TPH, and Physical).

Sample Location	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron			Cadmium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
TP4, Service Area 1 (Soil)	J1NPD9	4/11/12	6450		1.7	0.41	U	0.41	3.4		0.71	60.2		0.081	0.60		0.035	1.1	B	1.0	0.12	B	0.044
Duplicate of J1NPD9	J1NPF0	4/11/12	6240		1.7	0.41	U	0.41	3.4		0.71	58.0		0.081	0.60		0.035	1.0	U	1.0	0.07	B	0.044
TP1, Service Area 1 (Sediment)	J10FJ2	11/5/05	5040		9.3	2.4	UJ	2.4	2.1	U	2.1	71.4		0.12	0.06	U	0.06	12.1	J	1.6	0.43	U	0.43
TP1, Service Area 1 (Soil)	J10FH6	11/5/05	5290		3.8	0.83	U	0.83	2.8	C	0.71	66.6	C	0.04	0.15		0.02	1.5	C	0.56	0.15	U	0.15
Equipment Blank	J10FH4	11/5/05	52.7		1.8	0.38	U	0.38	0.33	UC	0.33	1.2	C	0.02	0.02		0.01	0.26	UC	0.26	0.07	U	0.07

Sample Location	HEIS Number	Sample Date	Calcium			Chromium			Cobalt			Copper			Hexavalent Chromium			Iron			Lead		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
TP4, Service Area 1 (Soil)	J1NPD9	4/11/12	4600		15.1	7.6		0.062	8.0	X	0.11	15.2		0.23	0.155	U	0.155	21700		4.1	3.6		0.29
Duplicate of J1NPD9	J1NPF0	4/11/12	4760		15.1	8.1		0.062	8.1	X	0.11	16.2		0.23	0.182		0.155	22200		4.1	3.4		0.29
TP1, Service Area 1 (Sediment)	J10FJ2	11/5/05	6240	C	7.3	13.4	J	0.98	7.1		0.73	17.6		0.88				19600		19.6	16.3		1.9
TP1, Service Area 1 (Sediment for Cr^{+6})	J10FJ9	11/5/05													3.5	U	3.5						
TP1, Service Area 1 (Soil)	J10FH6	11/5/05	7440	C	2.5	8.7	C	0.33	7.1	C	0.25	12.9		0.25	0.28		0.21	18900		6.7	4.0		0.64
Equipment Blank	J10FH4	11/5/05	24.4	C	1.1	0.29	C	0.15	0.12	UC	0.12	0.12	U	0.12				501		3.1	0.46		0.30

Sample Location	HEIS Number	Sample Date	Magnesium			Manganese			Mercury			Molybdenum			Nickel			Potassium			Selenium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
TP4, Service Area 1 (Soil)	J1NPD9	4/11/12	4390		4.0	337		0.11	0.0055	U	0.0055	0.28	U	0.28	10.2	M	0.13	952		43.9	0.92	U	0.92
Duplicate of J1NPD9	J1NPF0	4/11/12	4490		4.0	332		0.11	0.0061	B	0.0056	0.28	U	0.28	11.3		0.13	807		43.9	0.92	U	0.92
TP1, Service Area 1 (Sediment)	J10FJ2	11/5/05	3930		8.2	298		0.12	0.22		0.02	1.0		0.79	9.7		0.79	1100		33.8	2.2	U	2.2
TP1, Service Area 1 (Soil)	J10FH6	11/5/05	4200	C	2.8	295	C	0.04	0.01	U	0.01	0.42	C	0.27	10.6		0.27	997		11.5	0.75	UC	0.75
Equipment Blank	J10FH4	11/5/05	8.6	C	1.3	4.0	C	0.02	0.01	U	0.01	0.17	C	0.12	0.12	U	0.12	23.4		5.3	0.35	UC	0.35

Sample Location	HEIS Number	Sample Date	Silicon			Silver			Sodium			Uranium			Vanadium			Zinc			TPH		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
TP4, Service Area 1 (Soil)	J1NPD9	4/11/12	214		6.1	0.17	U	0.17	253		63.2	0.361		0.333	51.1		0.10	55.7	X	0.43			
Duplicate of J1NPD9	J1NPF0	4/11/12	267		6.1	0.17	U	0.17	267		63.2	0.362		0.330	54.3		0.10	49.7	X	0.43			
TP1, Service Area 1 (Sediment)	J10FJ2	11/5/05	352	J	5.0	0.85	U	0.85	176	C	5.0	1.06		0.019	45.9		0.55	71.1		0.30	144	U	144
TP1, Service Area 1 (Soil)	J10FH6	11/5/05	545	C	1.7	0.29	U	0.29	127	C	0.35	1.37		0.019	44.3	C	0.19	40.3		0.10			
Equipment Blank	J10FH4	11/5/05	59	C	0.79	0.13	U	0.13	5.9	C	0.16				0.09	C	0.09	0.76		0.05			

Sample Location	HEIS Number	Sample Date	TPH - Diesel			TPH - Diesel EXT			Percent moisture (wet sample)		
			ug/kg	Q	PQL	ug/kg	Q	PQL	%	Q	PQL
TP4, Service Area 1 (Soil)	J1NPD9	4/11/12	3900	J	720	8300		1100	6.6		0
Duplicate of J1NPD9	J1NPF0	4/11/12	2900	J	700	6600		1000	7.5		0

Attachment	1	Sheet No.	2 of 10
Originator	N. K. Schiffern	Date	10/10/12
Checked	C. H. Dobie	Date	10/10/12
Calc. No.	0100D-CA-V0488	Rev. No.	0

Attachment 1. 100-D-50:9 Subsite Service Area 1 Confirmatory Sampling Results. (Organics)

Constituents	Class	J1NPD9, TP4, Service Area 1 (Soil)			J1NPF0, Duplicate of J1NPD9			J10FJ2, TP1, Service Area 1 (Sediment)			J10FH6, TP1, Service Area 1 (Soil)		
		4/11/12			4/11/12			11/5/05			11/5/05		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
2,4,5-Trichlorophenoxyacetic acid	HERB							18	U	18			
2,4-Dichlorophenoxyacetic acid	HERB							47		18			
2-(2,4,5-Trichlorophenoxy)propionic acid	HERB							18	U	18			
2-secButyl-4,6-dinitrophenol(DNBP)	HERB							18	U	18			
4-(2,4-Dichlorophenoxy)butanoic acid	HERB							180	U	180			
Dalapon	HERB							180	U	180			
Dicamba	HERB							72	U	72			
Dichloroprop	HERB							180	U	180			
Pentachlorophenol	HERB							14	U	14			
Aroclor-1016	PCB	2.9	U	2.9	3.0	U	3.0	36	U	36	34	U	34
Aroclor-1221	PCB	8.3	U	8.3	8.6	U	8.6	36	U	36	34	U	34
Aroclor-1232	PCB	2.1	U	2.1	2.1	U	2.1	36	U	36	34	U	34
Aroclor-1242	PCB	4.8	U	4.8	5.0	U	5.0	36	U	36	34	U	34
Aroclor-1248	PCB	4.8	U	4.8	5.0	U	5.0	36	U	36	34	U	34
Aroclor-1254	PCB	2.7	U	2.7	2.8	U	2.8	36	U	36	34	U	34
Aroclor-1260	PCB	2.7	U	2.7	2.8	U	2.8	25	J	36	34	U	34
Aldrin	PEST	0.26	U	0.26	0.26	U	0.26	1.4	UD	1.4	1.4	UD	1.4
Alpha-BHC	PEST	0.22	U	0.22	0.22	U	0.22	1.4	UD	1.4	1.4	UD	1.4
alpha-Chlordane	PEST	0.34	U	0.34	0.33	U	0.33	1.4	UD	1.4	1.4	UD	1.4
beta-1,2,3,4,5,6-Hexachlorocyclohexane	PEST	0.69	U	0.69	0.68	U	0.68	1.4	UD	1.4	1.4	UD	1.4
Delta-BHC	PEST	0.42	U	0.42	0.41	U	0.41	1.4	UD	1.4	1.4	UD	1.4
4,4'-DDD	PEST	0.57	U	0.57	0.56	U	0.56	1.4	UD	1.4	1.4	UD	1.4
4,4'-DDE	PEST	0.25	U	0.25	0.25	U	0.25	1.2	JD	1.4	1.4	UD	1.4
4,4'-DDT	PEST	0.62	U	0.62	0.61	U	0.61	1.4	UD	1.4	1.4	UD	1.4
Dieldrin	PEST	0.22	U	0.22	0.22	U	0.22	1.4	UD	1.4	1.4	UD	1.4
Endosulfan I	PEST	0.18	U	0.18	0.18	U	0.18	1.4	UD	1.4	1.4	UD	1.4
Endosulfan II	PEST	0.30	U	0.30	0.30	U	0.30	1.4	UD	1.4	1.4	UD	1.4
Endosulfan sulfate	PEST	0.29	U	0.29	0.28	U	0.28	1.4	UD	1.4	1.4	UD	1.4
Endrin	PEST	0.32	U	0.32	0.32	U	0.32	1.4	UD	1.4	1.4	UD	1.4
Endrin aldehyde	PEST	0.18	UN	0.18	0.18	U	0.18	1.4	UD	1.4	1.4	UD	1.4
Endrin ketone	PEST	0.51	U	0.51	0.50	U	0.50	1.4	UD	1.4	1.4	UD	1.4
Gamma-BHC (Lindane)	PEST	0.48	U	0.48	0.48	U	0.48	1.4	UD	1.4	1.4	UD	1.4
gamma-Chlordane	PEST	0.28	U	0.28	0.27	U	0.27	1.4	UD	1.4	1.4	UD	1.4
Heptachlor	PEST	0.22	U	0.22	0.22	U	0.22	1.4	UD	1.4	1.4	UD	1.4
Heptachlor epoxide	PEST	0.44	U	0.44	0.44	U	0.44	1.4	UD	1.4	1.4	UD	1.4
Methoxychlor	PEST	0.47	UN	0.47	0.46	U	0.46	1.4	UD	1.4	1.4	UD	1.4
Toxaphene	PEST	16	U	16	16	U	16	14	UDJ	14	14	UD	14
1,2,4-Trichlorobenzene	SVOA	29	U	29	29	U	29	360	U	360	360	U	360
1,2-Dichlorobenzene	SVOA	22	U	22	23	U	23	360	U	360	360	U	360
1,3-Dichlorobenzene	SVOA	12	U	12	12	U	12	360	U	360	360	U	360
1,4-Dichlorobenzene	SVOA	14	U	14	14	U	14	360	U	360	360	U	360
2,4,5-Trichlorophenol	SVOA	10	U	10	10	U	10	910	U	910	890	U	890
2,4,6-Trichlorophenol	SVOA	10	U	10	10	U	10	360	U	360	360	U	360
2,4-Dichlorophenol	SVOA	10	U	10	10	U	10	360	U	360	360	U	360
2,4-Dimethylphenol	SVOA	67	U	67	68	U	68	360	U	360	360	U	360
2,4-Dinitrophenol	SVOA	340	U	340	350	U	350	910	U	910	890	U	890
2,4-Dinitrotoluene	SVOA	67	U	67	68	U	68	360	U	360	360	U	360
2,6-Dinitrotoluene	SVOA	29	U	29	29	U	29	360	U	360	360	U	360
2-Chloronaphthalene	SVOA	10	U	10	10	U	10	360	U	360	360	U	360
2-Chlorophenol	SVOA	21	U	21	22	U	22	360	U	360	360	U	360
2-Methylnaphthalene	SVOA	19	U	19	20	U	20	360	U	360	360	U	360
2-Methylphenol (cresol, o-)	SVOA	13	U	13	13	U	13	360	U	360	360	U	360

Attachment	1	Sheet No.	3 of 10
Originator	N. K. Schiffern	Date	10/10/12
Checked	C. H. Dobie	Date	10/10/12
Calc. No.	0100D-CA-V0488	Rev. No.	0

Attachment 1. 100-D-50:9 Subsite Service Area 1 Confirmatory Sampling Results. (Organics)

Constituents	Class	J1NPD9, TP4, Service Area 1 (Soil) 4/11/12			J1NPF0, Duplicate of J1NPD9 4/11/12			J10FJ2, TP1, Service Area 1 (Sediment) 11/5/05			J10FH6, TP1, Service Area 1 (Soil) 11/5/05		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
2-Nitroaniline	SVOA	51	U	51	52	U	52	910	U	910	890	U	890
2-Nitrophenol	SVOA	10	U	10	10	U	10	360	U	360	360	U	360
3+4 Methylphenol (cresol, m+p)	SVOA	34	U	34	34	U	34	360	U	360	360	U	360
3,3'-Dichlorobenzidine	SVOA	92	U	92	93	U	93	360	U	360	360	U	360
3-Nitroaniline	SVOA	75	U	75	76	U	76	910	U	910	890	U	890
4,6-Dinitro-2-methylphenol	SVOA	340	U	340	340	U	340	910	U	910	890	U	890
4-Bromophenylphenyl ether	SVOA	19	U	19	20	U	20	360	U	360	360	U	360
4-Chloro-3-methylphenol	SVOA	67	U	67	68	U	68	360	U	360	360	U	360
4-Chloroaniline	SVOA	84	U	84	85	U	85	360	U	360	360	U	360
4-Chlorophenylphenyl ether	SVOA	21	U	21	22	U	22	360	U	360	360	U	360
4-Nitroaniline	SVOA	74	U	74	75	U	75	910	U	910	890	U	890
4-Nitrophenol	SVOA	99	U	99	100	U	100	910	U	910	890	U	890
Acenaphthene	SVOA	11	U	11	11	U	11	22	J	360	360	U	360
Acenaphthylene	SVOA	17	U	17	18	U	18	360	U	360	360	U	360
Anthracene	SVOA	17	U	17	18	U	18	35	J	360	360	U	360
Benzo(a)anthracene	SVOA	20	U	20	21	U	21	160	J	360	360	U	360
Benzo(a)pyrene	SVOA	20	U	20	21	U	21	160	J	360	360	U	360
Benzo(b)fluoranthene	SVOA	27	U	27	27	U	27	150	J	360	360	U	360
Benzo(ghi)perylene	SVOA	16	U	16	17	U	17	92	J	360	360	U	360
Benzo(k)fluoranthene	SVOA	41	U	41	41	U	41	150	J	360	360	U	360
Bis(2-chloro-1-methylethyl)ether	SVOA	24	U	24	24	U	24	360	U	360	360	U	360
Bis(2-Chloroethoxy)methane	SVOA	24	U	24	24	U	24	360	U	360	360	U	360
Bis(2-chloroethyl) ether	SVOA	17	U	17	17	U	17	360	U	360	360	U	360
Bis(2-ethylhexyl) phthalate	SVOA	47	U	47	48	U	48	660	U	360	190	JB	360
Butylbenzylphthalate	SVOA	44	U	44	45	U	45	360	U	360	360	U	360
Carbazole	SVOA	37	U	37	37	U	37	20	J	360	360	U	360
Chrysene	SVOA	28	U	28	28	U	28	210	J	360	360	U	360
Di-n-butylphthalate	SVOA	30	U	30	30	U	30	360	U	360	360	U	360
Di-n-octylphthalate	SVOA	15	U	15	15	U	15	360	U	360	360	U	360
Dibenz[a,h]anthracene	SVOA	19	U	19	20	U	20	26	J	360	360	U	360
Dibenzofuran	SVOA	20	U	20	21	U	21	360	U	360	360	U	360
Diethylphthalate	SVOA	27	U	27	27	U	27	360	U	360	360	U	360
Dimethyl phthalate	SVOA	24	U	24	24	U	24	360	U	360	360	U	360
Fluoranthene	SVOA	37	U	37	37	U	37	260	J	360	360	U	360
Fluorene	SVOA	18	U	18	19	U	19	360	U	360	360	U	360
Hexachlorobenzene	SVOA	30	U	30	30	U	30	360	U	360	360	U	360
Hexachlorobutadiene	SVOA	10	U	10	10	U	10	360	U	360	360	U	360
Hexachlorocyclopentadiene	SVOA	51	U	51	52	U	52	360	U	360	360	U	360
Hexachloroethane	SVOA	22	U	22	22	U	22	360	U	360	360	U	360
Indeno(1,2,3-cd)pyrene	SVOA	22	U	22	23	U	23	78	J	360	360	U	360
Isophorone	SVOA	17	U	17	18	U	18	360	U	360	360	U	360
N-Nitroso-di-n-dipropylamine	SVOA	32	U	32	32	U	32	360	U	360	360	U	360
N-Nitrosodiphenylamine	SVOA	21	U	21	22	U	22	360	U	360	360	U	360
Naphthalene	SVOA	32	U	32	32	U	32	360	U	360	360	U	360
Nitrobenzene	SVOA	22	U	22	23	U	23	360	U	360	360	U	360
Pentachlorophenol	SVOA	340	U	340	340	U	340	910	U	910	890	U	890
Phenanthrene	SVOA	17	U	17	18	U	18	170	J	360	360	U	360
Phenol	SVOA	18	U	18	19	U	19	360	U	360	360	U	360
Pyrene	SVOA	12	U	12	13	U	13	320	J	360	360	U	360

Attachment	1	Sheet No.	4 of 10
Originator	N. K. Schiffern	Date	10/10/12
Checked	C. H. Dobie	Date	10/10/12
Calc. No.	0100D-CA-V0488	Rev. No.	0

Table B-1. 100-D-50:9 Subsite Service Area 1 Confirmatory Sampling Results. (Organics)

Constituents	Class	J10FH4, Equipment Blank		
		11/5/05		
		µg/kg	Q	PQL
Aroclor-1016	PCB			
Aroclor-1221	PCB			
Aroclor-1232	PCB			
Aroclor-1242	PCB			
Aroclor-1248	PCB			
Aroclor-1254	PCB			
Aroclor-1260	PCB			
Aldrin	PEST			
Alpha-BHC	PEST			
alpha-Chlordane	PEST			
beta-1,2,3,4,5,6-Hexachlorocyclohexane	PEST			
Delta-BHC	PEST			
4,4'-DDD	PEST			
4,4'-DDE	PEST			
4,4'-DDT	PEST			
Dieldrin	PEST			
Endosulfan I	PEST			
Endosulfan II	PEST			
Endosulfan sulfate	PEST			
Endrin	PEST			
Endrin aldehyde	PEST			
Endrin ketone	PEST			
Gamma-BHC (Lindane)	PEST			
gamma-Chlordane	PEST			
Heptachlor	PEST			
Heptachlor epoxide	PEST			
Methoxychlor	PEST			
Toxaphene	PEST			
1,2,4-Trichlorobenzene	SVOA	330	U	330
1,2-Dichlorobenzene	SVOA	330	U	330
1,3-Dichlorobenzene	SVOA	330	U	330
1,4-Dichlorobenzene	SVOA	330	U	330
2,4,5-Trichlorophenol	SVOA	830	U	830
2,4,6-Trichlorophenol	SVOA	330	U	330
2,4-Dichlorophenol	SVOA	330	U	330
2,4-Dimethylphenol	SVOA	330	U	330
2,4-Dinitrophenol	SVOA	830	U	830
2,4-Dinitrotoluene	SVOA	330	U	330
2,6-Dinitrotoluene	SVOA	330	U	330
2-Chloronaphthalene	SVOA	330	U	330
2-Chlorophenol	SVOA	330	U	330
2-Methylnaphthalene	SVOA	330	U	330
2-Methylphenol (cresol, o-)	SVOA	330	U	330

Constituents	Class	J10FH4, Equipment Blank		
		11/5/05		
		ug/kg	Q	PQL
2-Nitroaniline	SVOA	830	U	830
2-Nitrophenol	SVOA	330	U	330
3+4 Methylphenol (cresol, m+p)	SVOA	330	U	330
3,3'-Dichlorobenzidine	SVOA	330	U	330
3-Nitroaniline	SVOA	830	U	830
4,6-Dinitro-2-methylphenol	SVOA	830	U	830
4-Bromophenylphenyl ether	SVOA	330	U	330
4-Chloro-3-methylphenol	SVOA	330	U	330
4-Chloroaniline	SVOA	330	U	330
4-Chlorophenylphenyl ether	SVOA	330	U	330
4-Nitroaniline	SVOA	830	U	830
4-Nitrophenol	SVOA	830	U	830
Acenaphthene	SVOA	330	U	330
Acenaphthylene	SVOA	330	U	330
Anthracene	SVOA	330	U	330
Benzo(a)anthracene	SVOA	330	U	330
Benzo(a)pyrene	SVOA	330	U	330
Benzo(b)fluoranthene	SVOA	330	U	330
Benzo(ghi)perylene	SVOA	330	U	330
Benzo(k)fluoranthene	SVOA	330	U	330
Bis(2-chloro-1-methylethyl)ether	SVOA	330	U	330
Bis(2-Chloroethoxy)methane	SVOA	330	U	330
Bis(2-chloroethyl) ether	SVOA	330	U	330
Bis(2-ethylhexyl) phthalate	SVOA	120	JB	330
Butylbenzylphthalate	SVOA	330	U	330
Carbazole	SVOA	330	U	330
Chrysene	SVOA	330	U	330
Di-n-butylphthalate	SVOA	340		330
Di-n-octylphthalate	SVOA	330	U	330
Dibenz[a,h]anthracene	SVOA	330	U	330
Dibenzofuran	SVOA	330	U	330
Diethylphthalate	SVOA	26	J	330
Dimethyl phthalate	SVOA	330	U	330
Fluoranthene	SVOA	330	U	330
Fluorene	SVOA	330	U	330
Hexachlorobenzene	SVOA	330	U	330
Hexachlorobutadiene	SVOA	330	U	330
Hexachlorocyclopentadiene	SVOA	330	U	330
Hexachloroethane	SVOA	330	U	330
Indeno(1,2,3-cd)pyrene	SVOA	330	U	330
Isophorone	SVOA	330	U	330
N-Nitroso-di-n-dipropylamine	SVOA	330	U	330
N-Nitrosodiphenylamine	SVOA	330	U	330
Naphthalene	SVOA	330	U	330
Nitrobenzene	SVOA	330	U	330
Pentachlorophenol	SVOA	830	U	830
Phenanthrene	SVOA	330	U	330
Phenol	SVOA	330	U	330
Pyrene	SVOA	330	U	330

Attachment	1	Sheet No.	5 of 10
Originator	N. K. Schiffern	Date	10/10/12
Checked	C. H. Dobie	Date	10/10/12
Calc. No.	0100D-CA-V0488	Rev. No.	0

Attachment 1. 100-D-50:9 Subsite Service Area 2 Confirmatory Sample Results_Informational Purposes Only (Radionuclides).

Sample Location	HEIS Number	Sample Date	Americium-241 GEA			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
TP2, Service Area 2 (Sediment)	J10FH9	11/5/05	0.095	U	0.095	0.089	U	0.089	0.096	U	0.096	0.24	U	0.24	0.32	U	0.32	0.16	U	0.16
TP2, Service Area 2 (Soil)	J10FH5	11/5/05	0.13	U	0.13	0.036	U	0.036	0.037	U	0.037	0.084	U	0.084	0.12	U	0.12	0.094	U	0.094
TP3, Service Area 2 (Sediment)	J10FH7	11/5/05	0.41	U	0.41	2.16		0.15	0.21	U	0.21	0.28	U	0.28	0.36	U	0.36	0.27	U	0.27
Duplicate of J10FH7	J10FH8	11/5/05	0.26	U	0.26	3.70		0.12	0.17	U	0.17	0.43	U	0.43	0.49	U	0.49	0.27	U	0.27
TP3, Service Area 2 (Soil)	J10FH3	11/5/05	0.38	U	0.38	0.036	U	0.036	0.034	U	0.034	0.096	U	0.096	0.13	U	0.13	0.13	U	0.13

Sample Location	HEIS Number	Sample Date	Gross alpha			Gross beta			Potassium-40			Radium-226			Radium-228			Thorium-228 GEA		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
TP2, Service Area 2 (Sediment)	J10FH9	11/5/05	7.58		3.6	14.1		5.5	7.79		0.89	0.423		0.16	0.49	U	0.49	0.686	J	0.11
TP2, Service Area 2 (Soil)	J10FH5	11/5/05	6.03		3.7	19.4		6.4	12.6		0.37	0.568		0.069	0.86		0.15	0.718		0.044
TP3, Service Area 2 (Sediment)	J10FH7	11/5/05	6.80		3.5	18.7		5.6	10.0		1.2	0.564		0.20	0.64	U	0.64	0.399	J	0.13
Duplicate of J10FH7	J10FH8	11/5/05	9.42		3.3	18.7		5.6	8.27		1.2	0.82	U	0.82	0.96	U	0.96	0.502	J	0.20
TP3, Service Area 2 (Soil)	J10FH3	11/5/05	5.44		4.0	16.3		5.9	25.0		0.33	0.983		0.072	1.44		0.17	1.33		0.051

Sample Location	HEIS Number	Sample Date	Thorium-232 GEA			Uranium-235 GEA			Uranium-238 GEA		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
TP2, Service Area 2 (Sediment)	J10FH9	11/5/05	0.49	U	0.49	0.28	U	0.28	12	U	12
TP2, Service Area 2 (Soil)	J10FH5	11/5/05	0.860		0.15	0.13	U	0.13	4.6	U	4.6
TP3, Service Area 2 (Sediment)	J10FH7	11/5/05	0.64	U	0.64	0.39	U	0.39	13	U	13
Duplicate of J10FH7	J10FH8	11/5/05	0.96	U	0.96	0.48	U	0.48	17	U	17
TP3, Service Area 2 (Soil)	J10FH3	11/5/05	1.44		0.17	0.16	U	0.16	4.3	U	4.3

Attachment	1	Sheet No.	6 of 10
Originator	N. K. Schiffern	Date	10/10/12
Checked	C. H. Dobie	Date	10/10/12
Calc. No.	0100D-CA-V0488	Rev. No.	0

Attachment 1. 100-D-50:9 Subsite Service Area 2 Confirmatory Sample Results_Informational Purposes Only (Metals, TPH, and Physical).

Sample Location	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron			Cadmium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
TP2, Service Area 2 (Sediment)	J10FH9	11/5/05	5440		8.9	2.3	UJ	2.3	2.0	U	2.0	63.8		0.12	0.06	U	0.06	1.6	UJ	1.6	0.41	U	0.41
TP2, Service Area 2 (Soil)	J10FH5	11/5/05	5920		3.6	0.79	U	0.79	3.1	C	0.68	68.3	C	0.04	0.19		0.02	2.3	C	0.54	0.14	U	0.14
TP3, Service Area 2 (Sediment)	J10FH7	11/5/05	6580		10.4	2.9	J	2.7	2.7		2.3	485		0.14	0.14		0.07	2.8	J	1.8	2.8		0.48
Duplicate of J10FH7	J10FH8	11/5/05	6160		9.8	2.6	J	2.6	4.2		2.2	512		0.13	0.16		0.06	2.8	J	1.7	3.6		0.45
TP3, Service Area 2 (Soil)	J10FH3	11/5/05	5780		3.7	0.80	U	0.80	2.4	C	0.68	224	C	0.04	0.17		0.02	3.2	C	0.54	0.14	U	0.14

Sample Location	HEIS Number	Sample Date	Calcium			Chromium			Cobalt			Copper			Hexavalent Chromium			Iron			Lead		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
TP2, Service Area 2 (Sediment)	J10FH9	11/5/05	5400	C	7.0	8.0	J	0.94	6.2		0.70	12.8		0.85				17500		18.8	6.0		1.8
TP2, Service Area 2 (Sediment for Cr^{+6})	J10FJ6	11/5/05													3.5	U	3.5						
TP2, Service Area 2 (Soil)	J10FH5	11/5/05	4740	C	2.4	9.9	C	0.32	7.2	C	0.24	13.6		0.24	0.27		0.21	17700		6.4	4.0		0.62
TP3, Service Area 2 (Sediment)	J10FH7	11/5/05	14300	C	8.1	52.2	J	1.1	8.0		0.82	123		0.99				30200		22.0	160		2.1
TP3, Service Area 2 (Sediment for Cr^{+6})	J10FJ4	11/5/05													3.5	U	3.5						
Duplicate of J10FH7	J10FH8	11/5/05	22100	C	7.6	54.2	J	1.0	7.1		0.77	117		0.93				29400		20.6	160		2.0
Duplicate of J10FJ4	J10FJ5	11/5/05													3.5	U	3.5						
TP3, Service Area 2 (Soil)	J10FH3	11/5/05	11500	C	2.4	9.9	C	0.32	6.3	C	0.24	13.4		0.24	0.20	U	0.20	16900		6.4	3.7		0.62

Sample Location	HEIS Number	Sample Date	Magnesium			Manganese			Mercury			Molybdenum			Nickel			Potassium			Selenium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
TP2, Service Area 2 (Sediment)	J10FH9	11/5/05	3770		7.9	290		0.12	0.02	U	0.02	0.76	U	0.76	8.5		0.76	1140		32.5	2.1	UC	2.1
TP2, Service Area 2 (Soil)	J10FH5	11/5/05	4290	C	2.7	319	C	0.04	0.02	U	0.02	0.41	C	0.26	12.2		0.26	1020		11.0	0.71	UC	0.71
TP3, Service Area 2 (Sediment)	J10FH7	11/5/05	4920		9.2	386		0.14	5.7		0.11	2.5		0.89	30.5		0.89	1230		37.9	2.5	UC	2.5
Duplicate of J10FH7	J10FH8	11/5/05	4400		8.6	372		0.13	7.5		0.10	2.2		0.83	21.7		0.83	1160		35.5	3.1	C	2.3
TP3, Service Area 2 (Soil)	J10FH3	11/5/05	3970	C	2.7	288	C	0.04	0.01	U	0.01	0.58	C	0.26	10.3		0.26	842		11.1	0.72	UC	0.72

Sample Location	HEIS Number	Sample Date	Silicon			Silver			Sodium			Uranium			Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
TP2, Service Area 2 (Sediment)	J10FH9	11/5/05	503	J	4.8	0.82	U	0.82	164	C	4.8	1.04		0.019	38.2		0.53	38.2		0.29
TP2, Service Area 2 (Soil)	J10FH5	11/5/05	638	C	1.6	0.28	U	0.28	212	C	0.34	1.41		0.019	38.2	C	0.18	35.5		0.10
TP3, Service Area 2 (Sediment)	J10FH7	11/5/05	744	J	5.6	2.2		0.96	217	C	5.6	1.46		0.019	34.7		0.62	1560		0.34
Duplicate of J10FH7	J10FH8	11/5/05	845	J	5.2	2.6		0.90	226	C	2.3	1.66		0.019	33.5		0.58	1770		0.32
TP3, Service Area 2 (Soil)	J10FH3	11/5/05	667	C	1.6	0.28	U	0.28	189	C	0.34	1.47		0.019	37.6	C	0.18	36.8		0.10

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Checked	C. H. Dobie	Date	11/6/12
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Attachment 1. 100-D-50:9 Subsite Service Area 2 Confirmatory Sampling Results Informational Purposes Only (Organics)

Constituents	Class	J10FH9, TP2, Service Area 2 (Sediment) 11/5/2005			J10FH5, TP2, Service Area 2 (Soil) 11/5/2005			J10FH7, TP3, Service Area 2 (Sediment) 11/5/2005			J10FH8 Duplicate of J10FH7 11/5/2005		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Aroclor-1016	PCB	35	U	35	34	U	34	41	U	41	38	U	38
Aroclor-1221	PCB	35	U	35	34	U	34	41	U	41	38	U	38
Aroclor-1232	PCB	35	U	35	34	U	34	41	U	41	38	U	38
Aroclor-1242	PCB	35	U	35	34	U	34	41	U	41	38	U	38
Aroclor-1248	PCB	35	U	35	34	U	34	41	U	41	38	U	38
Aroclor-1254	PCB	35	U	35	34	U	34	41	U	41	38	U	38
Aroclor-1260	PCB	35	U	35	34	U	34	290		41	200		38
Aldrin	PEST	1.4	UD	1.4	1.4	UD	1.4	4.1	UD	4.1	3.8	UD	3.8
Alpha-BHC	PEST	1.4	UD	1.4	1.4	UD	1.4	4.1	UD	4.1	3.8	UD	3.8
alpha-Chlordane	PEST	1.4	UD	1.4	1.4	UD	1.4	4.1	UD	4.1	3.8	UD	3.8
beta-1,2,3,4,5,6-Hexachlorocyclohexane	PEST	1.4	UD	1.4	1.4	UD	1.4	4.1	UD	4.1	3.8	UD	3.8
Delta-BHC	PEST	1.4	UD	1.4	1.4	UD	1.4	4.1	UD	4.1	3.8	UD	3.8
4,4'-DDD	PEST	1.4	UD	1.4	1.4	UD	1.4	4.1	UD	4.1	3.8	UD	3.8
4,4'-DDE	PEST	1.4	UD	1.4	1.4	UD	1.4	6.6	DJ	4.1	6.5	DJ	3.8
4,4'-DDT	PEST	1.4	UD	1.4	1.4	UD	1.4	4.1	UD	4.1	3.8	UD	3.8
Dieldrin	PEST	1.4	UD	1.4	1.4	UD	1.4	3.7	JD	4.1	3.2	JD	3.8
Endosulfan I	PEST	1.4	UD	1.4	1.4	UD	1.4	4.1	UD	4.1	3.8	UD	3.8
Endosulfan II	PEST	1.4	UD	1.4	1.4	UD	1.4	7.6	DJ	4.1	5.6	DJ	3.8
Endosulfan sulfate	PEST	1.4	UD	1.4	1.4	UD	1.4	4.1	UD	4.1	6.9	ID	3.8
Endrin	PEST	1.4	UD	1.4	1.4	UD	1.4	4.1	UD	4.1	3.8	UD	3.8
Endrin aldehyde	PEST	1.4	UD	1.4	1.4	UD	1.4	4.1	UD	4.1	3.8	UD	3.8
Endrin ketone	PEST	1.4	UD	1.4	1.4	UD	1.4	4.1	UD	4.1	3.8	UD	3.8
Gamma-BHC (Lindane)	PEST	1.4	UD	1.4	1.4	UD	1.4	4.1	UD	4.1	3.8	UD	3.8
gamma-Chlordane	PEST	1.4	UD	1.4	1.4	UD	1.4	4.1	UD	4.1	3.8	UD	3.8
Heptachlor	PEST	1.4	UD	1.4	1.4	UD	1.4	4.1	UD	4.1	3.8	UD	3.8
Heptachlor epoxide	PEST	1.4	UD	1.4	1.4	UD	1.4	4.1	UD	4.1	3.8	UD	3.8
Methoxychlor	PEST	1.4	UD	1.4	1.4	UD	1.4	10	D	4.1	3.8	UD	3.8
Toxaphene	PEST	14	UDJ	14	14	UD	14	41	UDJ	41	38	UDJ	38
1,2,4-Trichlorobenzene	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
1,2-Dichlorobenzene	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
1,3-Dichlorobenzene	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
1,4-Dichlorobenzene	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
2,4,5-Trichlorophenol	SVOA	870	U	870	860	U	860	4100	UD	4100	3800	UD	3800
2,4,6-Trichlorophenol	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
2,4-Dichlorophenol	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
2,4-Dimethylphenol	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
2,4-Dinitrophenol	SVOA	870	U	870	860	U	860	4100	UD	4100	3800	UD	3800
2,4-Dinitrotoluene	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
2,6-Dinitrotoluene	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
2-Chloronaphthalene	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
2-Chlorophenol	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
2-Methylnaphthalene	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
2-Methylphenol (cresol, o-)	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500

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Attachment 1. 100-D-50:9 Subsite Service Area 2 Confirmatory Sampling Results Informational Purposes Only (Organics)

Constituents	Class	J10FH9, TP2, Service Area 2 (Sediment) 11/5/2005			J10FH5, TP2, Service Area 2 (Soil) 11/5/2005			J10FH7, TP3, Service Area 2 (Sediment) 11/5/2005			J10FH8 Duplicate of J10FH7 11/5/2005		
		ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
2-Nitroaniline	SVOA	870	U	870	860	U	860	4100	UD	4100	3800	UD	3800
2-Nitrophenol	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
3+4 Methylphenol (cresol, m+p)	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
3,3'-Dichlorobenzidine	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
3-Nitroaniline	SVOA	870	U	870	860	U	860	4100	UD	4100	3800	UD	3800
4,6-Dinitro-2-methylphenol	SVOA	870	U	870	860	U	860	4100	UD	4100	3800	UD	3800
4-Bromophenylphenyl ether	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
4-Chloro-3-methylphenol	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
4-Chloroaniline	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
4-Chlorophenylphenyl ether	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
4-Nitroaniline	SVOA	870	U	870	860	U	860	4100	UD	4100	3800	UD	3800
4-Nitrophenol	SVOA	870	U	870	860	U	860	4100	UD	4100	3800	UD	3800
Acenaphthene	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
Acenaphthylene	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
Anthracene	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
Benzo(a)anthracene	SVOA	350	U	350	340	U	340	640	JD	1600	270	JD	1500
Benzo(a)pyrene	SVOA	350	U	350	340	U	340	760	JD	1600	360	JD	1500
Benzo(b)fluoranthene	SVOA	350	U	350	340	U	340	710	JD	1600	340	JD	1500
Benzo(ghi)perylene	SVOA	350	U	350	340	U	340	400	JD	1600	230	JD	1500
Benzo(k)fluoranthene	SVOA	350	U	350	340	U	340	650	JD	1600	310	JD	1500
Bis(2-chloro-1-methylethyl)ether	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
Bis(2-Chloroethoxy)methane	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
Bis(2-chloroethyl) ether	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
Bis(2-ethylhexyl) phthalate	SVOA	660	U	350	63	JB	340	660	U	1600	660	U	1500
Butylbenzylphthalate	SVOA	350	U	350	340	U	340	210	JD	1600	100	JD	1500
Carbazole	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
Chrysene	SVOA	350	U	350	340	U	340	650	JD	1600	290	JD	1500
Di-n-butylphthalate	SVOA	20	J	350	340	U	340	1600	UD	1600	1500	UD	1500
Di-n-octylphthalate	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
Dibenz[a,h]anthracene	SVOA	350	U	350	340	U	340	94	JD	1600	1500	UD	1500
Dibenzofuran	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
Diethylphthalate	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
Dimethyl phthalate	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
Fluoranthene	SVOA	350	U	350	340	U	340	600	JD	1600	230	JD	1500
Fluorene	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
Hexachlorobenzene	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
Hexachlorobutadiene	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
Hexachlorocyclopentadiene	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
Hexachloroethane	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
Indeno(1,2,3-cd)pyrene	SVOA	350	UJ	350	340	U	340	390	JD	1600	160	JD	1500
Isophorone	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
N-Nitroso-di-n-dipropylamine	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
N-Nitrosodiphenylamine	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
Naphthalene	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
Nitrobenzene	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
Pentachlorophenol	SVOA	870	U	870	860	U	860	4100	UD	4100	3800	UD	3800
Phenanthrene	SVOA	350	U	350	340	U	340	250	JD	1600	88	JD	1500
Phenol	SVOA	350	U	350	340	U	340	1600	UD	1600	1500	UD	1500
Pyrene	SVOA	350	U	350	340	U	340	760	JD	1600	300	JD	1500

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Checked	C. H. Dobie	Date	10/10/12
Calc. No.	0100D-CA-V0488	Rev. No.	0

Attachment 1. 100-D-50:9 Subsite Service Area 2 Confirmatory Sampling Results Informational Purposes Only (Organics)

Constituents	Class	J10FH3, TP3, Service Area 2 (Soil) 11/5/05		
		µg/kg	Q	PQL
Aroclor-1016	PCB	34	U	34
Aroclor-1221	PCB	34	U	34
Aroclor-1232	PCB	34	U	34
Aroclor-1242	PCB	34	U	34
Aroclor-1248	PCB	34	U	34
Aroclor-1254	PCB	34	U	34
Aroclor-1260	PCB	34	U	34
Aldrin	PEST	1.4	UD	1.4
Alpha-BHC	PEST	1.4	UD	1.4
alpha-Chlordane	PEST	1.4	UD	1.4
beta-1,2,3,4,5,6-Hexachlorocyclohexane	PEST	1.4	UD	1.4
Delta-BHC	PEST	1.4	UD	1.4
4,4'-DDD	PEST	1.4	UD	1.4
4,4'-DDE	PEST	1.4	UD	1.4
4,4'-DDT	PEST	1.4	UD	1.4
Dieldrin	PEST	1.4	UD	1.4
Endosulfan I	PEST	1.4	UD	1.4
Endosulfan II	PEST	1.4	UD	1.4
Endosulfan sulfate	PEST	1.4	UD	1.4
Endrin	PEST	1.4	UD	1.4
Endrin aldehyde	PEST	1.4	UD	1.4
Endrin ketone	PEST	1.4	UD	1.4
Gamma-BHC (Lindane)	PEST	1.4	UD	1.4
gamma-Chlordane	PEST	1.4	UD	1.4
Heptachlor	PEST	1.4	UD	1.4
Heptachlor epoxide	PEST	1.4	UD	1.4
Methoxychlor	PEST	1.4	UD	1.4
Toxaphene	PEST	14	UD	14
1,2,4-Trichlorobenzene	SVOA	340	U	340
1,2-Dichlorobenzene	SVOA	340	U	340
1,3-Dichlorobenzene	SVOA	340	U	340
1,4-Dichlorobenzene	SVOA	340	U	340
2,4,5-Trichlorophenol	SVOA	850	U	850
2,4,6-Trichlorophenol	SVOA	340	U	340
2,4-Dichlorophenol	SVOA	340	U	340
2,4-Dimethylphenol	SVOA	340	U	340
2,4-Dinitrophenol	SVOA	850	U	850
2,4-Dinitrotoluene	SVOA	340	U	340
2,6-Dinitrotoluene	SVOA	340	U	340
2-Chloronaphthalene	SVOA	340	U	340
2-Chlorophenol	SVOA	340	U	340
2-Methylnaphthalene	SVOA	340	U	340
2-Methylphenol (cresol, o-)	SVOA	340	U	340

Constituents	Class	J10FH3, TP3, Service Area 2 (Soil) 11/5/05		
		ug/kg	Q	PQL
2-Nitroaniline	SVOA	850	U	850
2-Nitrophenol	SVOA	340	U	340
3+4 Methylphenol (cresol, m+p)	SVOA	340	U	340
3,3'-Dichlorobenzidine	SVOA	340	U	340
3-Nitroaniline	SVOA	850	U	850
4,6-Dinitro-2-methylphenol	SVOA	850	U	850
4-Bromophenylphenyl ether	SVOA	340	U	340
4-Chloro-3-methylphenol	SVOA	340	U	340
4-Chloroaniline	SVOA	340	U	340
4-Chlorophenylphenyl ether	SVOA	340	U	340
4-Nitroaniline	SVOA	850	U	850
4-Nitrophenol	SVOA	850	U	850
Acenaphthene	SVOA	340	U	340
Acenaphthylene	SVOA	340	U	340
Anthracene	SVOA	340	U	340
Benzo(a)anthracene	SVOA	340	U	340
Benzo(a)pyrene	SVOA	340	U	340
Benzo(b)fluoranthene	SVOA	340	U	340
Benzo(ghi)perylene	SVOA	340	U	340
Benzo(k)fluoranthene	SVOA	340	U	340
Bis(2-chloro-1-methylethyl)ether	SVOA	340	U	340
Bis(2-Chloroethoxy)methane	SVOA	340	U	340
Bis(2-chloroethyl) ether	SVOA	340	U	340
Bis(2-ethylhexyl) phthalate	SVOA	91	JB	340
Butylbenzylphthalate	SVOA	340	U	340
Carbazole	SVOA	340	U	340
Chrysene	SVOA	340	U	340
Di-n-butylphthalate	SVOA	340	U	340
Di-n-octylphthalate	SVOA	340	U	340
Dibenz[a,h]anthracene	SVOA	340	U	340
Dibenzofuran	SVOA	340	U	340
Diethylphthalate	SVOA	340	U	340
Dimethyl phthalate	SVOA	340	U	340
Fluoranthene	SVOA	340	U	340
Fluorene	SVOA	340	U	340
Hexachlorobenzene	SVOA	340	U	340
Hexachlorobutadiene	SVOA	340	U	340
Hexachlorocyclopentadiene	SVOA	340	U	340
Hexachloroethane	SVOA	340	U	340
Indeno(1,2,3-cd)pyrene	SVOA	340	U	340
Isophorone	SVOA	340	U	340
N-Nitroso-di-n-dipropylamine	SVOA	340	U	340
N-Nitrosodiphenylamine	SVOA	340	U	340
Naphthalene	SVOA	340	U	340
Nitrobenzene	SVOA	340	U	340
Pentachlorophenol	SVOA	850	U	850
Phenanthrene	SVOA	340	U	340
Phenol	SVOA	340	U	340
Pyrene	SVOA	340	U	340

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Originator	N. K. Schiffern	Date	10/10/12
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APPENDIX C

DATA QUALITY ASSESSMENT

APPENDIX C

DATA QUALITY ASSESSMENT

CONFIRMATORY SAMPLING

A data quality assessment (DQA) was performed to compare the sampling approach and analytical data with the sampling and data requirements specified in the site specific work instructions (WCH 2005d, 2012a). This DQA was performed in accordance with WCH-EE-01, Environmental Investigations Procedures. Specific data quality objectives for the site are found in the *100 Area Remedial Action Sampling and Analysis Plan* (SAP) (DOE-RL 2009). A review of the work instruction (WCH 2005d, WCH 2012a), the field logbooks (WCH, 2005a, 2005b, 2005c, and WCH 2012b), and applicable analytical data packages has been performed as part of this DQA. To ensure quality data, the 100 Area SAP data assurance requirements and the validation procedures are used as appropriate (BHI 2000a, 2000b). This review involves evaluation of the data to determine if it is of the right type, quality, and quantity to support the intended use (i.e., closeout decisions [EPA 2000]). The DQA completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality objectives process.

All samples were collected per the sample design (WCH 2005d, WCH 2012a). Data from samples collected at the 100-D-50:9 site were provided by the laboratories in four sample delivery groups (SDGs): SDG K0096, SDG J00013, SDG K0094, and SDG J01476. Third-party data validation was performed on SDG K0096.

SDG K0096

SDG K0096 consists of four field samples (J10FJ2, J10FH7, J10FH8, and J10FH9) analyzed for semivolatile organic compounds (SVOCs), chlorinated pesticides, polychlorinated biphenyls (PCBs), inductively coupled plasma (ICP) metals, mercury, uranium by kinetic phosphorescence analysis (KPA), gross alpha, and gross beta. Additionally, SDG K0096 was analyzed by gamma analysis.

Herbicide and total petroleum hydrocarbon (TPH) analyses were also performed on sample J10FJ2, but not called for in the work instruction. This was the result of a miscommunication between the project and the laboratory. There were no issues in the herbicide data. In the TPH analysis of sample J10FJ2, TPH was not detected. The required quantitation limit (RQL) for TPH was not met. Third-party validation did not assign any qualifiers to the TPH result for exceeding the method detection limit (MDL).

Third-party data validation assigned "J" qualifiers to all of the results in SDG K0096 for the analytes silicon, antimony, boron, total chromium, thorium-228, indeno(1,2,3-cd)pyrene, and toxaphene. The silicon and antimony qualifiers were due to laboratory control sample (LCS) recoveries that were below the acceptance criteria at 42.7% and 49.5%, respectively. The boron, total chromium, and thorium-228 qualifiers were due to relative percent differences (RPDs), between the duplicate and main sample, that were above the acceptance criteria at 108%, 33%, and 55%. Indeno(1,2,3-cd)pyrene results were qualified because of matrix spike (MS) and LCS recoveries below the acceptance criteria, at 55% and 56%. Quality control (QC) samples did not include the analyte toxaphene; therefore, all of the toxaphene results in SDG K0096 were qualified with "J" as estimates.

Due to method blank (MB) contamination all of the analytical results in SDG K0096 for bis(2ethylhexyl) phthalate were raised to the RQL and requalified with "U" as nondetected. High recoveries in the MS for 4,4'-DDE, and 2,4-DB at 127% and 129% resulted in "J" qualifiers for all detected results for those analytes in SDG K0096.

The qualification in SDG K0096 is typical of samples collected from sewer systems, which represent a complex matrix from an analytical point of view. The "J" qualifications on data indicate an increase in the "error bars" associated with the data due to minor deficiencies in the data sets. No major deficiencies in SDG K0096 were found. Therefore, the data remain usable for decision-making purposes.

SDG J00013

SDG J00013 consists of four field samples (J10FJ4, J10FJ5, J10FJ6, and J10FJ9) from 100-D-50:9 that were analyzed for hexavalent chromium. Two sets of MS and matrix spike duplicate (MSD) were run; one set was below criteria at 59% and 57%, respectively. The other MS/MSD pair were within criteria at 79% and 87%, respectively. The low recovery in the first pair is a laboratory error that was corrected by running the second pair with the field samples. The RQL was not met for hexavalent chromium in SDG J00013. The MDL is set as a multiplier of the instrument detection limit. This is done because analytical systems generally are able to detect the presence of analytes at lower levels than they are able to accurately quantify them. Analytes detected and reported below the MDLs are assigned "J" qualifiers by the laboratories to indicate the estimated nature of such data. In this case, if hexavalent chromium were present in these pipe sediment samples above the RAG value, its presence would have been expected even though those values would be below the MDL.

SDG K0094

SDG K0094 consists of four field samples (J10FH3, J10FH4, J10FH5, and J10FH6) that were analyzed for hexavalent chromium, SVOCs, chlorinated pesticides, PCBs, ICP metals, mercury, uranium by KPA, gross alpha, gross beta, and by gamma analysis.

In the SVOC analysis the common laboratory contaminant bis(2-ethylhexyl)phthalate was found in the MB, all of the other QC samples, and in all of the field samples. All of the bis(2-ethylhexyl)phthalate results are below the remedial action goal (RAG) values and will not impact any decisions made with the data. Also in the SVOC analysis, low recoveries were found in the MS/MSD pairs for the analytes indeno(1,2,3-cd)pyrene (56%/51%) and benzo(g,h,i)perylene (46%/44%). The deficiencies found in the SVOC analysis are all considered minor, and the data are usable for decision-making purposes.

In the chlorinated pesticide analysis the analyte 4,4'-DDD had high recoveries in the MS, the MSD, and the LCS at 152%, 149%, and 136%, respectively. The analyte endosulfan II had high recoveries in the MS and MSD at 133% and 132%, respectively. Also in the chlorinated pesticides the analyte beta-BHC had a high recovery in the MSD at 147%. Increased recoveries in the QA samples suggest a high bias in the quantitation of the field samples. However, the field samples were all nondetect. Therefore, there is no impact on the sample data, which are usable for decision making purposes. The analyte toxaphene was not included in the laboratory quality assurance (QA)/QC testing.

In the metals analysis for SDG K0094 three analyte RPDs, from the duplicate sample, were out of criteria. The RPDs for boron, barium, and molybdenum were 66.7%, 105.9%, and 61.2%. Difficulty in producing truly homogeneous mixtures of soils is well known, and the lack of homogenous sample materials often times results in high RPDs for both field and laboratory duplicates. It is likely that more essentially inert material (e.g., larger size rock or cobble) was present in one sample. The data are usable for decision-making purposes. Also in the metals analysis, the analytes barium, calcium, sodium, and molybdenum had concentrations in the MB that were above the MDL. All molybdenum sample results are less than 20 times the MB value. The barium calcium and sodium concentrations in sample J10FH4 were less than 20 times the MB values.

The deficiencies found in the metals analysis are all considered minor and suggest that the barium, calcium, sodium, and molybdenum data may be considered estimated. No major deficiencies were found, and the data are usable for decision-making purposes.

SDG J01476

SDG J01476 comprises confirmatory samples collected in 2012, whereas the balance of the confirmatory samples were collected in 2005. These samples were indicated in a recent white paper (WCH 2012) to be included as part of the 100-D-50:9 confirmatory sampling.

SDG J01476 comprises one focused sample (J1NPD9) and a duplicate (J1NPF0). These samples were analyzed for SVOCs, chlorinated pesticides, PCBs, TPH (diesel range), and ICP metals including mercury.

In the pesticide analysis, the MS and MSD for endrin aldehyde (11%, 0%) and the MS for methoxychlor (66%) are below the QC limits. The RPDs for these analytes are also outside QC range. Acceptable LCS results indicate the analytical system was functioning appropriately and suggest matrix interference for these analytes. Results for endrin aldehyde and methoxychlor may be considered estimated. Estimated data are usable for decision-making purposes.

In the TPH-diesel analysis, a detection in the MB led to reextraction and reanalysis of the samples. The samples were collected on April 11, 2012, and the reextraction was performed on May 2, 2012, resulting in an effective holding time of 21 days, which is less than twice the standard holding time for TPH-diesel of 14 days. TPH-diesel results for SDG J01476 may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the RPD calculated for nickel is above the QC limit (30%) at 31%. Elevated RPDs in environmental samples are generally attributed to natural heterogeneities in the sample matrix. There is no significant impact to the field sample data. The data are usable for decision-making purposes.

In the ICP metals analysis, the laboratory has run a serial dilution as a QC check. The serial dilution suggests physical and or chemical interferences for the analytes cobalt and zinc. The laboratory has qualified these data with "X" flags. Results for cobalt and zinc may be considered estimated. Estimated data are usable for decision-making purposes.

FIELD QUALITY ASSURANCE/QUALITY CONTROL

Relative percent difference evaluations of main sample(s) versus the laboratory duplicate(s) are routinely performed and reported by the laboratory. Any deficiencies in those calculations are reported by SDG in the previous sections.

Field QA/QC measures are used to assess potential sources of error and cross contamination of samples that could bias results. Field QA/QC samples, listed in the field logbook (WCH 2012b), are shown in Table C-1. The main and QA/QC sample results are presented in Appendix B.

Table C-1. Field Quality Assurance/Quality Control Samples.

Sample Area	Main Sample	Duplicate Sample
Service Area 1	J1NPD9	J1NPF0

Field duplicate samples are collected to provide a relative measure of the degree of local heterogeneity in the sampling medium, unlike laboratory duplicates that are used to evaluate precision in the analytical process. The field duplicates are evaluated by computing the RPD of the sample/duplicate pair(s) for each contaminant of potential concern (COPC). Relative percent differences are not calculated for analytes that are not detected in both the main and duplicate sample at more than five times the target detection limit (TDL). Relative percent differences of analytes detected at low concentrations (less than five times the detection limit) are not considered to be indicative of the analytical system performance. The calculation brief in Appendix B provides details on duplicate pair evaluation and RPD calculation.

None of the RPD calculated for the field duplicate sample are above the acceptance criteria (30%). A secondary check of the data variability is used when one or both of the samples being evaluated (main and duplicate) is less than five times the TDL, including undetected analytes. In these cases, a control limit of ±2 times the TDL is used (Appendix B) to indicate that a visual check of the data is required by the reviewer. No sample results required this check. A visual inspection of all of the data is also performed. No additional major or minor deficiencies are noted. The data are usable for decision-making purposes.

Summary

Limited, random, or sample matrix-specific influenced batch QC issues such as these are a potential for any analysis. The number and types seen in these data sets were within expectations for the matrix types and analyses performed.

The DQA review for the 100-D-50:9 site found the results to be accurate within the standard errors associated with the methods, including sampling and sample handling. The DQA review for the 100-D-50:9 site concludes that the data reviewed is of the right type, quality, and quantity to support the intended use. Detection limits, precision, accuracy, and sampling data group completeness were assessed to determine if any analytical results should be rejected as a result of quality assurance and quality control deficiencies. All analytical data were found acceptable for decision-making purposes. The confirmatory sample analytical data are stored in the Environmental Restoration (ENRE) project-specific database prior to archiving in the Hanford Environmental Information System (HEIS) and are summarized in Appendix B.

VERIFICATION SAMPLING

A DQA was performed to compare the verification sampling approach and resulting analytical data with the sampling and data requirements specified in the site-specific sample design (WCH 2012c). This DQA was performed in accordance with site specific data quality objectives found in the SAP (DOE-RL 2009).

A review of the sample design (WCH 2012c), the field logbook (WCH 2012b), and applicable analytical data packages has been performed as part of this DQA. All samples were collected and analyzed per the sample design. To ensure quality data, the SAP data assurance requirements and the data validation procedures for chemical analysis and radiochemical analysis (BHI 2000a, 2000b) are used as appropriate. This review involves evaluation of the data to determine if they are of the right type, quality, and quantity to support the intended use (i.e., closeout decisions). The DQA completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality objectives process (EPA 2006).

Verification sample data collected at the 100-D-50:9 subsite, service area 2 were provided by the laboratories in three SDGs: SDG JP0406, SDG JP0406, and SDG JP0408. SDG JP0406 was submitted for third-party validation. No major deficiencies were identified in the analytical data set. Minor deficiencies are discussed for the 100-D-50:9 subsite, service area 2 data set, as follows below. If no comments are made about a specific analysis, it should be assumed that no deficiencies affecting the quality of the data were found.

SDG JP0406

This SDG comprises 13 statistical soil samples (J1R058 through J1R070) collected from the 100-D-50:9 subsite, service area 2 excavation area. In addition, one focused sample (J1R071) was collected from the northernmost excavation where no pipe was found to be present. This SDG includes one field duplicate pairs (J1P058/J1R070). These samples were analyzed for gamma energy analysis (GEA), ICP metals, mercury, hexavalent chromium, polycyclic aromatic hydrocarbons, PCBs, and pesticides. SDG JP0406 was submitted for third-party validation. Minor deficiencies are as follows:

In the pesticide analysis, all of the toxaphene results for SDG JP0406 were qualified as estimated and flagged "J" by third-party validation due to the lack of a MS, MSD, and LCS analysis. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, barium, calcium, potassium, and zinc were detected in the MB at low levels. Calcium and potassium are not regulated constituents and are not COPCs for the 100-D-50:9 subsite, service area 2. Barium and zinc concentrations were much higher in the field samples than in the MB. Therefore, there is no impact to the field sample data. The data are usable for decision-making purposes.

In the ICP metals analysis, the LCS recovery for silicon is below the laboratory and project recovery limits, at 19%. All silicon results in SDG JP0406 were qualified as estimated by third-party validation with "J" flags. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the MS recoveries were outside the project acceptance criteria for five analytes (aluminum, antimony, iron, manganese, and silicon). For aluminum, iron, and manganese, the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. The deficiency in the MS is a reflection of the variability of the native concentration rather than a measure of the recovery from the sample. Antimony and silicon did not have mismatched spike and native concentrations in the MS. The MS recoveries for antimony and silicon were 53% and 17%, respectively. All antimony and silicon results for SDG JP0406 were qualified as estimated by third-party validation with "J" flags. Estimated data are usable for decision-making purposes.

SDG JP0407

This SDG comprises 13 statistical soil samples (J1R072 through J1R084) collected from the overburden staging pile. This SDG includes one field duplicate pair (J1R083/J1R084). These samples were analyzed for GEA, ICP metals, mercury, hexavalent chromium, polycyclic aromatic hydrocarbons, PCBs, and pesticides. In addition, one equipment blank (J1R085) was collected and analyzed for ICP metals and mercury. Minor deficiencies are as follows:

In the ICP metals analysis, the LCS recovery for silicon is below the laboratory and project recovery limits at 19%. All silicon results in SDG JP0407 are may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the MS recoveries were out of project acceptance criteria for five analytes (aluminum, antimony, iron, manganese, and silicon). For aluminum, iron, and manganese, the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. The deficiency in the MS is a reflection of the variability of the native concentration rather than a measure of the recovery from the sample. Antimony and silicon did not have mismatched spike and native concentrations in the MS.

The MS recoveries for antimony and silicon were 54%, and 13%, respectively. All antimony and silicon results for SDG JP0407 were qualified as estimated by third-party validation with "J" flags. Estimated data are usable for decision-making purposes.

SDG JP0408

This SDG comprises 13 statistical soil samples (J1R086 through J1R098) collected from the staging pile area. This SDG includes one field duplicate pair (J1R087/J1R098). These samples were analyzed for GEA, ICP metals, mercury, hexavalent chromium, polycyclic aromatic hydrocarbons, PCBs, and pesticides. Minor deficiencies are as follows:

In the pesticide analysis, the 4,4-DDT RPD between the primary and confirmatory columns for sample J1R096 is above the laboratory QC limit of 40%. The laboratory performed a Florasil cleanup on sample J1R096 to reduce matrix interferences. However, due to the matrix interference for 4,4-DDT, the result was qualified and flagged "X" by the laboratory. This result may be considered estimated. Estimated data are usable for decision-making purposes.

In the PCB analysis, samples J1R094, J1R095, and J1R096 contained more than one Aroclor component. The laboratory performed a sulfuric acid cleanup on the samples to reduce matrix interferences. The J1R094, J1R095, and J1R096 PCB results may be considered estimated. Estimated data are usable for decision-making purposes.

In the PAH analysis, the RPD between primary and confirmatory columns exceeded the laboratory QC limit of 40% for benzo(b)fluoranthene in sample J1R088 due to matrix interference. Therefore, the benzo(b)fluoranthene in sample J1R088 was qualified and flagged "X" by the laboratory. This result may be considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, nickel was detected in the MB at low levels. Nickel was detected at significantly smaller concentrations than its associated, most stringent cleanup limit, and is detected at significantly higher concentrations in field samples. The data are usable for decision-making purposes.

In the ICP metals analysis, the LCS recovery for silicon is below the laboratory and project recovery limits, at 16%. All silicon results in SDG JP0408 are considered estimated. Estimated data are usable for decision-making purposes.

In the ICP metals analysis, the MS recoveries were out of project acceptance criteria for five analytes (aluminum, antimony, iron, manganese, and silicon). For aluminum, iron, and manganese, the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. The deficiency in the MS is a reflection of the variability of the native concentration rather than a measure of the recovery from the sample. Antimony and silicon did not have mismatched spike and native concentrations in the MS. The MS recoveries for antimony and silicon were 52%, and 16%, respectively. All antimony and silicon results for SDG JP0408 were qualified as estimated by third-party validation with "J" flags. Estimated data are usable for decision-making purposes.

FIELD QUALITY ASSURANCE/QUALITY CONTROL

Relative percent difference evaluations of main sample(s) versus the laboratory duplicate(s) are routinely performed and reported by the laboratory. Any deficiencies in those calculations are reported by SDG in the previous sections.

Field QA/QC measures are used to assess potential sources of error and cross contamination of samples that could bias results. Field QA/QC samples, listed in the field logbook (WCH 2012), are shown in Table C-2. The main and QA/QC sample results are presented in Appendix B.

Table C-2. Field Quality Assurance/Quality Control Samples.

Sample Area	Main Sample	Duplicate Sample
Excavation Area	J1R058	J1R070
Overburden Stockpile Area	J1R087	J1R098
Staging Pile Area	J1R083	J1R084

Field duplicate samples are collected to provide a relative measure of the degree of local heterogeneity in the sampling medium, unlike laboratory duplicates that are used to evaluate precision in the analytical process. The field duplicates are evaluated by computing the RPD of the sample/duplicate pair(s) for each COPC. Relative percent differences are not calculated for analytes that are not detected in both the main and duplicate sample at more than five times the target detection limit (TDL). Relative percent differences of analytes detected at low concentrations (less than five times the detection limit) are not considered to be indicative of the analytical system performance. The calculation brief in Appendix B provides details on duplicate pair evaluation and RPD calculation.

None of the RPDs calculated for the field duplicate sample are above the acceptance criteria (30%). A secondary check of the data variability is used when one or both of the samples being evaluated (main and duplicate) is less than five times the target detection limit (TDL), including undetected analytes. In these cases, a control limit of ±2 times the TDL is used (Appendix B) to indicate that a visual check of the data is required by the reviewer. No sample results required this check. A visual inspection of all of the data is also performed. No additional major or minor deficiencies are noted. The data are usable for decision-making purposes.

Summary

Limited, random, or sample matrix-specific influenced batch QC issues such as those discussed above are a potential for any analysis. The number and types seen in these data sets are within expectations for the matrix types and analyses performed. The DQA review of the 100-D-50:9 subsite, service area 2 verification sampling data found that the analytical results are accurate within the standard errors associated with the analytical methods, sampling, and sample handling. The DQA review for 100-D-50:9 subsite, service area 2 concludes that the reviewed data are of the right type, quality, and quantity to support the intended use. The analytical data were found acceptable for decision-making purposes.

The verification sample analytical data are stored in the Environmental Restoration project-specific database prior to being submitted for inclusion in the Hanford Environmental Information System database. The verification sample analytical data are also summarized in Appendix B.

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